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Metals Review

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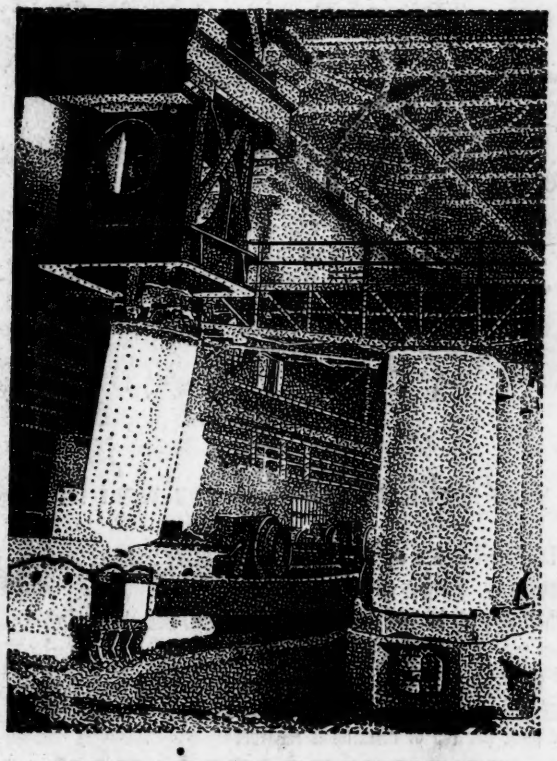
FERROUS METALS ISSUE



Featuring

Ferrous Metals
Production and Properties

By S. L. Case

Battelle Memorial Institute

Highlights of research and development as reflected in recent technical literature (with reference to source numbers in the Review of Current Metal Literature).

Products and Processes for the Steel Plant

Ore handling equipment, melting furnaces and accessories, refractories, plant laboratory equipment, new steels and improved compositions, as described by the manufacturers during the past year.

NOTABLE LECTURES
Reported This Month

Robert F. Mehl addresses entering freshmen at Carnegie Tech on "The Nature of Engineering Education", published here as a contribution from the chairman of the A.S.M. Advisory Committee on Metallurgical Education . . . Cyril Smith outlines the purpose and functions of the Institute for the Study of Metals at Chicago U, and tells of work done there on recrystallization and grain growth in brass . . . H. W. Hinkley tells of the many variables in materials and methods specifications confronting the aeronautical design and process engineer, and the enormous latitude in designing and producing the B-36 . . . B. H. Miller points out that a lubricant should be chosen for its corrosion resistance as well as its antifriction properties.

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Metals Review

Vol. XX, No. 10

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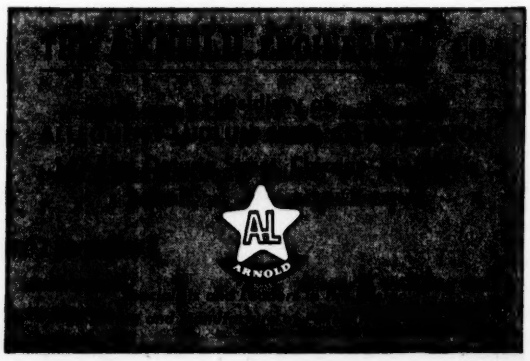

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Ferrous Metals — Their Production and Properties

Highlights of Research and Developments as Reflected in Recent Technical Literature

by S. L. Case

Battelle Memorial Institute

THE IRON AND STEEL industry of the United States has enjoyed in the past a unique economic advantage—namely, an ample supply of high-grade ore. For years, the open pits of the Mesaba Range have supplied more than three-fourths of our normal ore requirements, with little if any beneficiation. This period is drawing to close. The Mesaba Range has met the vast war demands by appreciably shortening its normal life, and the timetable has been advanced considerably for commercial treatment of its taconites which, as is generally recognized, are the only known long-term reserves that will feed our blast furnaces in the foreseeable future.

Ore Beneficiation

The depletion of high-grade ore reserves has made it necessary to concentrate the leaner ores, and most of the operating companies on the Mesaba Range have established ore beneficiation laboratories to supplement the work done by the Minnesota Mines Experimental Station. The mine laboratories are not entirely concerned with gazing into the future, since they are generally an integral part of full-scale ore beneficiating plants. The production of every piece of equipment used in a plant flow sheet is studied in the laboratory and analyzed at each step of the process.

The late developments in beneficiation practices were reviewed by G. J. Holt (1-8, March 1946).* Most of the beneficiation plants employ the "straight wash" flow sheet. The washing plants in the Mesaba Range (which produce the heaviest tonnage of concentrates at present) are beneficiating plants only in the sense that they divide the crude ore into waste and concentrate on the basis of difference in particle size between the two. The potential loss of iron in the fine waste which overflows the classifiers in the "straight wash" process is receiving much attention, and the sink-float process is gradually replacing it.

The sink-float process employs finely ground, 15% ferrosilicon in water suspension, for gravity separation of concentrates. The process is divided into two steps; in the first or concentration step the waste siliceous material is floated out of the concentrating cone containing the ferrosilicon suspension of predetermined and controlled specific gravity. The second step is the reclamation and cleaning of the ferrosilicon medium. Reclamation is by water-spray washing over vibrating screens, and subsequent cleaning is by magnetic separation.

A recent development in the sink-float process has been the substitution of the Akins concentrator for the rising-current type. This concentrator is actually a heavy-duty spiral classifier containing the medium, with a rearrangement of the ore inflow and the tailing outflow. The concentrates are raked out of the bottom of a relatively quiescent pool, with but little loss of medium. This development opens the field to a treatment of the finer sizes of ore which were heretofore lost as waste in the older type of concentrating cone.

The final step in beneficiation of lean ores—an essential step in proper utilization of fine ores—is sintering. Variables in the operation of a sintering plant may affect seriously the quality of sinter as measured by its influence on the output of a blast furnace. In view of the sharp differences of opinion on what constitutes "good" sinter, its production as reviewed by T. W. Plante (1-1, Feb. 1947) is of timely interest.

Ore beneficiation practice in foreign countries is treated in a description of the Krupp-Renn Process (1-18, April 1946) and beneficiation of very lean Salzgitter ores in Germany (1-25, March 1947).

Blast-Furnace Practice

Judging from technical papers, few novel ideas in blast-furnace operations were advanced during the past 12 months. Of general interest is a series of articles by F. Mobey (2-8 and 2-13, Feb. 1946; 2-33 and 2-40, April 1946) dealing with the physical chemistry of the blast furnace; and T. L. Joseph in his Howe Memorial Lecture (2-63, June 1946) covered the postwar shifts in emphasis on blast-furnace controls. The use of scrap in the blast-furnace charge was discussed by K. Neustaetter (2-70, June 1946) and methods of treating blast-furnace slags, so as to produce a light-weight building material, were touched upon by H. O. Wicks (2-36, April 1946). An apparatus for cleaning blast-furnace gas without the use of water, described by F. E. Kling (2-136, Dec. 1946), is an apparently effective filter made of asbestos and glass fiber. Certain advantages are claimed over a conventional gas washer with an electric precipitator.

Operation of the blast furnace under elevated top pressure appears to offer considerable promise when associated mechanical difficulties are overcome. F. Janecek (2-39, April 1946) claims that with the resulting improved wind distribution, a large-diameter blast furnace can produce tonnages per square foot of hearth diameter fully equal to those now attainable only in small furnaces.

The Openhearth Process

As usual, the physical chemistry of the openhearth process received its share of attention. Brower and Larsen (2-106, July 1947) have ably covered the carbon-oxygen interaction during the refining stage in the openhearth. Their study centered on the activity of oxygen in the slag when a steady state is approached—a condition generally attained at the end of the refining period. Oxygen content of the metal appears to be independent of the slag composition over the range commonly used in both acid and basic furnaces. Its normal variability in excess of the quantity corresponding to equilibrium with carbon and carbon monoxide at atmospheric pressure is largely independent of any of the measured quantities, such as rate of carbon drop, iron oxide content of the slag, or its viscosity. The variability in oxygen content of the molten steel seems to be due mainly to difference in condition of the hearth surface, which affects the ease of bubble formation at the lower surface of the metal.

An ingenious explanation of the carbon-oxygen reaction in the refining stage was given by C. E. Sims (2-16, March 1947). The basic premise of the mechanism advanced by the author to explain the variability in oxygen content of molten steel is the fact that the solubility of CO in molten steel is appreciable, and cannot be ignored in calculating equilibrium conditions between carbon, iron, and oxygen. The reaction between carbon and oxygen in molten steel is practically instantaneous. This builds up a pressure of carbon monoxide which escapes from the

*Literature references are designated by the corresponding item number in the Review of Current Metal Literature rather than by repeating the entire title, author and source; the reader can get this information by referring to *Metals Review* for the month indicated.

eel under favorable condtions, that , at the hearth surface or by diffuon into rising bubbles. The variable olubility of this gas with pressure isturbs the apparent equilibrium beween carbon and oxygen, resulting in n excess of oxygen over equilibrium alue—the so-termed Δ[O] (2-106, July 947).

Sims contends that if the carbon nonoxide in solution in the molten ath is taken into account, equilibrium onditions are satisfied by the follow- ng equation:

$$\%C \times \%O = m \times P_{CO}$$

n whic' P_{CO} is the pressure of carbon monoxide.

This gives a close approximation to the actual oxygen found by analyse of samples taken during the steady state, so that the value of Δ[O] is reduced to zero, if it is assumed that carbon monoxide is present in liquid steel at pressures in excess of one atmosphere.

In a study of dephosphorizing action of various slag made by Winkler and Chipman (2-61, June 1946), radioactive phosphorus was used to arrive at the time interval needed to establish equilibrium. Successive metal samples could then be tested with a Geiger counter until a constant value was reached, giving a reasonable assurance of equilibrium conditions. The effect of slag composition on the activity of oxides and free lime content of the slag was illustrated in ternary diagrams. Dephosphorization is improved by the following factors:

1. Decreased temperature.
2. Increased iron oxide content.
3. Increased basicity of the slag accomplished by increasing either the lime or magnesia content of the slag, or decreasing its silica content.
4. Increased manganese oxide content of the slag.

This paper puts a quantitative interpretation on a reaction, the qualitative features of which are fairly generally recognized and accepted.

Grant and Chipman studied the desulphurizing action of basic openhearth slags (2-62, June 1946) in an effort to establish whether the lime in the slag or the manganese in the metal is the primary means of desulphurization. From experiments conducted under carefully controlled conditions on induction furnace melts it was concluded that:

1. MnO and MgO on a mol per mol basis are as effective as CaO in desulphurizing steel.
2. Slag FeO has only a dilution effect on the sulphur ratio between slag and metal. CaO does not appear, therefore, to be a controlling desulphurizing agent, as contended by earlier investigators.
3. On a mol per mol basis, alumina requires the same amount of CaO to neutralize it as does SiO_2.
4. Temperature in the range of 2800 to 3000° F. shows no measurable effect on the sulphur distribution between slag and metal. Temperatures greater than 3000° F. appear to have a slightly harmful effect, while temperatures under 2800° F. favor desulphurization.
5. Fluorspar does not affect the sulphur ratio.
6. Sulphur distribution between slag and metal is controlled almost entirely by the excess of base over acid, and the relationship is almost linear.
7. Carbon does not appear to affect the sulphur distribution.

The effect of temperature indicated by this study is contrary to some widely held beliefs among practical steelmen.

Recent British developments in steelmaking are covered by Kilby and Cameron (2-81, June 1947). Mold life and mold practice is a matter of practical interest to operating men. In this connection, S. W. House (2-8, Feb. 1947) says that a single graphite mold produced over 500 steel ingots—a 500% increase over the average life of cast iron molds. Surface quality of the steel is improved, and a more homogeneous ingot structure obtained.

Samuel L. Case joined the staff of Battelle Memorial Institute in 1944, after 17 years of association with Jones and Laughlin Steel Corp., first as supervisor of the metallurgical division of the Pittsburgh Works, later as supervisor of research, and, finally, as technical advisor of the research and development laboratory. He was born in Russia and educated at the Kiev Polytechnic Institute

Low-Cost Oxygen

The most widely discussed topic in smelting and refining of iron and steel during the past year was the use of oxygen, or oxygen-enriched air.

The idea of using oxygen in blast furnace or converter operations has recurred to practical steelmen from time to time for the past 30 years. Interest was purely academic, however, because of the high cost of oxygen. This picture is changed now. The remarkable lowering of the manufacturing cost of commercially pure oxygen (2-58, May 1947) was one of the most useful technological developments of World War II. The Linde-Fraenkl process has revolutionized the low-pressure fractionation method of oxygen manufacture, so that production of metallurgical oxygen (98% pure) in large plants delivering gas at low pressure for continuous use, may be under $6 a ton, as compared with the present price of $60 a ton. An oxygen plant of 500,000 tons yearly capacity—it is authoritatively predicted—will produce oxygen at $4 a ton; in larger plants the cost may be under $3 a ton (2-155, Sept. 1947).

Oxygen in Blast Furnaces

While the use of oxygen in blast-furnace operation remained only a topic of conversation in the United States, considerably more progress was made in Germany and Russia where economic considerations were secondary to government planning. The most detailed history of the Russian developments was given by I. P. Bardin (2-34, April 1947) who points out that the first attempts to use oxygen-enriched air in a blast furnace were made in Belgium in 1910-1913. These attempts were resumed in 1922, but were abandoned as uneconomical. The oxygen enrichment of the blast in these experiments was only about 5%.

The first Russian experiments were started in 1932 on a small experimental blast furnace having a volume of only 900 cu.ft. The blast was not preheated and the experiments indicated that the oxygen in the blast could be raised to 60% without causing unusual operating difficulties. The furnace was used for making ferrosilicon, ferromanganese, silicomanganese, and gray iron. When the oxygen in the blast was raised to 60%, the calorific value of the blast furnace gas was up to 320 B.t.u. per cu.ft., as compared with 90 B.t.u. in conventional practice.

Production runs on a larger blast furnace were carried out in U.S.S.R. in 1940-41. The blast furnace had a volume of 7700 cu.ft. (a hearth diameter of 10 ft., 4 in.). The oxygen content of the blast was 25 to 27% on one run and 29 to 33% on another run. The blast was preheated to 1300° F.

The furnace was used for the manufacture of 10% ferrosilicon. Its daily production in conventional operation was 100 tons of ferrosilicon, which was raised to 160 to 180 tons with 25 to 27% oxygen in the air. When the oxygen was raised to 29 to 33%, production rose to 220 tons daily; however, the furnace exhibited a tendency to hang when the oxygen content of the blast reached 33%. Coke consumption per ton of ferrosilicon averaged 4600 lb. in conventional operations; it dropped to 4000 lb. with 25 to 27% oxygen in the blast, and was fur-

ther reduced to 3200 lb. when the oxygen reached 33%.

These experiments were interrupted by World War II and have been resumed in 1947 on a somewhat larger furnace operating on pig iron (hearth diameter of 15 ft., total height 73 ft). The objective of these studies is to find means of utilizing lean ores, and thus increase the output of existing plants. The experiments are still in progress but indicate that if the cost of oxygen were roughly one-third that of pig iron, it would be economical to use a blast containing 30% oxygen.

In spite of earlier, enthusiastically optimistic press releases, stating that a new, revolutionary process of oxygen manufacture by the Kapitza method would reduce the manufacturing costs of oxygen in the U.S.S.R. to the equivalent of $3 a ton, this figure up till now appears to be only a gleam in Mr. Kapitza's eye. However, with oxygen at $4 or $5 a ton now a reality in the United States, and with the cost of pig iron soaring to $35 a ton, the use of oxygen in the blast furnace is a very timely subject.

Oxygen in the Bessemer Converter

The high nitrogen content of conventionally blown bessemer steel greatly limits its use. If it were possible and economical to blow a converter with pure oxygen instead of air, the nitrogen content of the blown metal would be as low or lower than that of openhearth steel, because the high rate of carbon removal in the converter would facilitate the removal of much of the nitrogen originally present in the iron. There are no recorded attempts to operate a bessemer converter on pure oxygen or even oxygen-enriched air in the United States, but in Germany the use of oxygen-enriched air in basic bessemer converters was reduced to practice in 1936. The converters were bottom blown and the maximum oxygen content of the blast was 31%. For some unstated reason, the German practice was to blow the converter on enriched air and switch to ordinary air for the afterblow.

The German practice as well as detailed Russian experiments evidently based on German work were described by V. V. Kondakov (2-35, April 1947). In the Russian work, preliminary experiments were started in 1934. They were exploratory in nature and indicated that a side-blown converter can be operated on commercially pure oxygen; however, refractory trouble stopped further experiments at that stage.

The Russian experiments were renewed in 1945 using a specially designed, 2-ton, acid-lined, bottom-blown converter. It was designed along conventional lines, with a bottom area of 6 sq.ft., and was equipped with nine 0.55-in. tuyeres; depth of the bath in the experimental blows was 11 to 16 in. Altogether, 15 blows were made: commercially pure oxygen was used on 11 blows; two blows were made with a blast containing 70% oxygen, and two blows with 50% oxygen.

In the initial blows erosion of the tuyeres was severe, so the converter was cooled after each blow, the tuyeres replaced, and the converter preheated to 1800 or 1900° F. before starting the next blow; two or three days, therefore, elapsed between blows.

Starting pressure was 12 lb., raised to about 17 or 18 lb. during the first 30 sec. During the first minute, heavy brown fumes of manganese and iron oxide issued from the mouth of the converter and an intense carbon flame was generally established at the end of 60 sec. The total blowing time averaged about 4.5 min. for a pure oxygen blast, 11 min. for a 75% oxygen blast, and 13 min. for a 50% oxygen blast. Oxygen efficiency was appreciably greater on pure oxygen and oxygen-enriched blows than on regular air blows. Oxygen consumption on the experimental blows averaged 1400 cu.ft. per ton of blown metal, while on conventional air blows, the requirements were 10,000 cu.ft. of air, equivalent to 2100 cu.ft. of oxygen per ton of metal.

The composition of converter slag on experimental blows averaged about 45 to 55% SiO_2, 10 to 40% FeO, 15 to 25% MnO, balance Fe_2O_3, Al_2O_3, CaO, etc. The quality of the finished steel was good as far as physical properties were concerned. Nitrogen content of this steel ranged from 0.001 to 0.006%, which was lower than the nitrogen content of the cupola iron from which the steel was blown. Normal air blows have a nitrogen content of 0.012 to 0.015%.

Erosion of the converter lining on the 15 experimental blows was very slight; however, the tuyere erosion was so severe that application of pure oxygen or oxygen-enriched air to bottom-blown converters in the U.S.S.R. will be held in abeyance until superior tuyere refractories are developed.

Oxygen in the Openhearth

Ever since the pioneering experiments at the Hamilton Plant of the Steel Co. of Canada, nearly five years ago, the use of oxygen in the openhearth has received considerable attention in the United States. In the initial experiments, oxygen was used in the burner in order to attain higher combustion temperatures and accelerate the meltdown of the scrap. More recently, oxygen has been introduced into the molten bath in order to shorten the refining period (2-146, Dec. 1946; 2-156, Jan. 1947; 2-159, Jan. 1947; and 2-153, Jan. 1947).

A survey of data from 728 heats made in nine openhearth shops shows an average reduction of 12.5% in meltdown time when oxygen was used to raise the flame temperature when melting the scrap. An average of results from all heats indicates that 3½ tons of oxygen is required to save 1 hr. furnace time on a 200-ton furnace. With the present price of $60 per ton of oxygen, its use would not be economically justified, but with the predicted price of $4 to $5 a ton in large installations, the use of oxygen for melting scrap would be sound practice.

A more effective way of using oxygen after the scrap has been heated to over 2000° F. is to direct an oxygen lance against the solid metal; the hot scrap burns, generating great heat, and the superheated liquid metal, saturated with oxide, flows down through the incandescent mass below, giving up its heat to the bath, instead of losing about 75% through the ports in the products of combustion, when oxygen is used for burning fuel.

A more economical way of using oxygen in the openhearth appears to be its introduction into the molten bath during the refining period. E. B. Hughes (2-122, July 1947) describes such a practice at the Steubenville Works of Wheeling Steel Corp. Oxygen is introduced into the bath at 100-lb. pressure, by means of a pipe through a wicket hole. Under normal practice, 2½ hr. is required to reduce the carbon from 0.10 to 0.04%. With oxygen, this carbon drop is accomplished in 30 to 48 min. From 10,000 to 19,000 cu.ft. of oxygen was used for a 160-ton heat, so that even at the cost of $3.35 per thousand cu.ft. ($80.40 per ton of oxygen) the practice was economically sound. F. B. Lounsberry (2-18, March 1947) describes a similar practice at Allegheny Ludlum Steel Corp., where oxygen was added to the bath to bring the carbon down to extremely low values (0.02% or under). On a 90-ton heat, about 20,000 cu.ft. of oxygen will bring the bath from 0.29 to 0.03% carbon; however, about 16,000 additional cu.ft. is required to drop the carbon below 0.02%. At the high carbon level, the efficiency of oxygen is very high, so that the oxygen requirements are considerably lower than the theoretical values necessary to oxidize the carbon to carbon monoxide. This is because the violent boil accelerates the normal action of slag and furnace atmosphere in removing carbon. In the low-carbon range, the rate of carbon drop when using oxygen is very much lower than at the higher carbon level, but it is still considerably higher than can be obtained through the use of ore, or by poling.

Attempts to remove large amounts of carbon in the high-carbon range with oxygen alone caused excessive heating of the bath. Oxygen, however, will accelerate the rate of the ore reaction by rapidly establishing a bath temperature favorable to a rapid ore boil, and by compensating for the heat losses of the carbon-ore reaction.

Oxygen additions, while generally made through a lance thrust into the metal bath to a depth of 6 to 10 in., can also be made by impingement on the surface of the bath at high velocity (2-57, May 1947).

(Turn to page 45)

A.S.M. Review of Current Metal Literature

An Annotated Survey of Engineering, Scientific and Industrial Journals and Books Here and Abroad, Received in the Library of Battelle Memorial Institute, Columbus, Ohio, During the Past Month.

1 ORES & RAW MATERIALS Production; Beneficiation

1-105. Effect of Oxidation on Floatability and Separation of Sulphide Minerals. I. N. Plaksin, A. I. Sinel'nikova, and G. N. Khazhimskaia. *Bulletin of the Academy of Sciences of U.S.S.R. (Section of Technical Sciences)*, no. 4, 1947, p. 425-438. (In Russian.)

Effect of oxygen in selective flotation processes. Separation of sulphide bearing minerals is accelerated by aeration, particularly when the pH of the medium is between 7.0 and 11.0. Introduction of oxygen into the flotation medium has a somewhat more pronounced effect than aeration.

1-106. Investigation Into the Chemical and Physical Nature of Silicated Nickel Minerals and the Process of Their Calcination and Reduction. G. G. Urazov and D. P. Bogatzky. *Comptes Rendus de l'Academie des Sciences de l'U.R.S.S.* v. 55, no. 9, 1947, p. 837-839. (In English.)

An investigation of five Russian nickel silicate ores.

1-107. Particle Discrimination in Flotation. A. M. Gaudin. *Deco Trefoil*, v. 11, July-Aug. 1947, p. 5-8.

Principles and applications of flotation. Eleven fundamental problems for future research. (Reprinted from *Technology Review*.)

1-108. Oxide Flotation at Darwin. *Mining World*, v. 9, Aug. 1947, p. 23-26, 70-71.

Development at Anaconda's California operation provides basis for mill expansion and adoption of alternate oxide-sulphide flowsheet.

1-109. Wartime Treatment of the Lead-Zinc Dumps Situated at Nenthead, Cumberland. E. W. O. Dawson. *Bulletin of the Institution of Mining and Metallurgy*, Aug. 1947, p. 35-43.

Discussion of a paper on possible economic and commercial importance of war treatment of lead-zinc dumps.

1-110. Mineral Contents of Bubbles During Flotation. Z. V. Volkova. *Engineers' Digest (American Edition)*, v. 4, June 1947, p. 295.

New method based on time of induction, wetting characteristics of mineral surfaces, speed with which the bubble is rising and size of the bubble, ratio of the mineral to be floated to other solid contents, and size of mineral particles. Theory and experimental results for a mixture of quartz and barite. (Translated and abstracted from *Gornii Journal (U.S.S.R.)*, no. 3, 1946, p. 30-35.)

1-111. Measuring Method for Magnetic Properties of Ores. V. J. Karamasin and B. J. Naygolnikov. *Engineers' Digest (American Edition)*, v. 4, June 1947, p. 295-296.

Principle of the measurements consists in suspending a 1-cc. lump of ore on a thread from one arm of the beam, and balancing it by weights on the pan, before closing the circuit exciting the magnet. With crushed ore samples, same volume is included in a celluloid cube and treated like the lump. (Translated and abstracted from *Zavodskaja Laboratoriya (U.S.S.R.)*, no. 7-8, 1946, p. 712-717.)

1-112. Concentration of Manganese Ores From Lincoln County, Nev. B. K. Shibler, W. W. Agey, and A. O. Ipsen. *Bureau of Mines, Report of Investigations 4111*, Aug. 1947, 19 p.

The amenability to concentration of 8 types of ores was investigated. Three samples were amenable to the production of satisfactory manganese concentrates. Two were roasted and sintered to produce Pb-Ag-Zn fumes and residues of possible value as manganiferous iron ore. One ore gave no marketable recoveries of manganese, but gave 80% recoveries of lead, silver, and zinc by bulk sulphide flotation followed by fuming of the concentrate. No satisfactory results were obtained from two of the samples.

1-113. Electrostatic Treatment of a Tantalite-Cassiterite Concentrate from Greenbushes. *Metallurgical Laboratory, University of Melbourne, Ore-Dressing Investigation no. 294*, Jan. 30, 1946, 10 p.

Electrostatic treatment of the product of magnetic separation. While a fair separation was obtained by magnetic treatment, electrostatic treatment of the products failed to make a substantial improvement in their quality.

1-114. Cyanidation of Lancefield Dump Calcines. *Metallurgical Laboratory, University of Melbourne, Ore-Dressing Investigation no. 306*, Oct. 14, 1946, 6 p.

Test results on three samples with respect to the practicability of cyanidation by flotation.

1-115. Iron Country Mine Operators Press for Maximum Tonnage. A. H. Hubbell. *Engineering and Mining Journal*, v. 148, Sept. 1947, p. 84-85.

New developments in the Lake Superior iron country.

1-116. Continuous Centrifuge in the Mineral Industry. S. C. Lyons and A. L. Johnson. *Mining Technology*, v. 2, July 1947, T. P. 2195, 11 p.

Principal types of centrifuges and their applications in the industry. Advantages and disadvantages of continuous centrifugal processes.

1-117. Milling Practices at Concentrator of Morenci Reduction Works. B. H. Cody. *Mining Technology*, v. 2, July 1947, T. P. 2194, 26 p.

Type of ore and operating data for 1942 to Sept. 1, 1946. Flow sheets for primary and secondary crushing, grinding, flotation and regrinding of concentrate, filtration of concentrate, water supply and consumption, and tailings disposal. Copper is recovered from a medium-hard monzonite porphyry in which the principal sulphide minerals are chalcocite and pyrite.

1-118. A Short-Cut Method of Metallurgical Accounting. E. H. Crabtree, Jr., and Neil S. Parker. *Mining Technology*, v. 2, July 1947, T. P. 2193, 3 p.

Calculation procedure developed for use in custom-milling plant of the Eagle-Picher Mining and Smelting Co. Special slotted sheets are used to solve the three and four-product formulas given in "Taggart's Handbook of Ore Dressing".

1-119. Milling Practice at New Lead-Zinc Concentrator of Phelps Dodge Corp. R. C. Thompson. *Mining Technology*, v. 2, July 1947, T. P. 2192, 10 p.

Mill designed for all-flotation treatment of 450 tons of lead-zinc ore per day and type of ore.

1-120. Milling Lead-Zinc Ores at Iron King Mine, Prescott, Arizona. H. R. Hendricks. *Mining Technology*, v. 2, July 1947, T. P. 2191, 5 p.

Development of a satisfactory procedure with the present flow sheet and milling practice. Lead, zinc, gold, silver, and pyrite are recovered.

1-121. Standard Grindability Tests Tabulated. Fred C. Bond. *Mining Technology*, v. 2, July 1947, T. P. 2180, 17 p.

Results of grindability tests on a wide variety of ores, made in the Allis-Chalmers laboratory since 1943, when the last list was published. Standard ball-mill and standard rod-mill grindability tests, impact-crushing tests, and comparative open-circuit and standard grindability tests at 200-mesh.

1-122. Rod Milling—Plant and Laboratory Data. J. F. Myers, S. D. Michaelson, and F. C. Bond. *Mining Technology*, v. 2, July 1947, T. P. 2175, 11 p.

Thirteen wet rod-milling and one roll-crushing operation, in which different ores were ground to different sizes under different conditions. Laboratory rod-mill grindability tests were made on each ore, and the plant-grinding efficiencies were calculated.

1-123. The Flotation of Fluorite. Enid C. Plante. *Mining Technology*, v. 2, July 1947, T. P. 2163, 19 p.

Experiments with several long-chain collectors available commercially and the use of sodium cetyl sulphate as a collector for fluorite. Laboratory tests and extension of the work to batch tests in the flotation machine. A method for determining the adsorption of sodium cetyl sulphate on fluorite. 28 ref.

For additional annotations indexed in other sections, see: 2-200-213; 25-141; 26-132-136-137; 27-177-196.

2 SMELTING AND REFINING

2-200. Physical-Chemical Investigations of Oxidized Ferro-Nickel Ores. G. G. Urazov and D. P. Bogatzky. *Comptes Rendus de l'Academie des Sciences de l'U.R.S.S.* v. 56, no. 1, 1947, p. 61-63. (In English.)

A study of ore behavior during calcining and reduction, as a basis for suggested new methods of chemical-metallurgical processing shows the scheme of reduction. Possibility of selectively obtaining nickel from the oxide minerals by reduction of oxidized ferronickel ores.

2-201. Factors Retarding the Blast Furnace Reaction: $2CO = C + CO_2$. I. Chufarov and M. F. Antonova. *Bulletin of the Academy of Sciences of U.S.S.R. (Section of Technical Sciences)*, no 4, 1947, p. 381-389. (In Russian.)

Effect of various poisons on iron oxide used as a catalyst for the reduction of CO. In blast furnace operations this reaction tends to shorten the life of the furnace lining due to interstitial deposition of carbon in the refractories. Sulphates and sulphides are active "poisons", which can retard the breakdown of CO very effectively. 12 ref.

2-202. Blast Furnace Smelting of Titaniferrous Ores With Basic Slags. I. V. Shmanenkov and K. Kh. Tagirov. *Bulletin of the Academy of Sciences of U.S.S.R. (Section of Technical Sciences)*, no. 4, 1947, p. 391-397. (In Russian.)

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PRODUCTS AND PROCESSES

for the Steel Plant

New Production Equipment, Improved Compositions, as Described by the Manufacturers

WITH THE RECENTLY publicized danger that the supply of high-grade iron ores will be exhausted in 20 to 30 years, iron ore companies are turning to beneficiating processes to render the plentiful low-grade ores usable. Such concentration will be done near the mines in the rich Lake Superior district. General Electric Co., foreseeing the need for much new electrical equipment to operate the crushing and screening, concentration and sintering plants, has assigned a special staff of engineers to study new electrical systems for the process. These will be of special character owing to the fact that the valuable mineral in the rock is magnetite. Some of this equipment is already being supplied for pilot plants in the early stages of the beneficiation program (R-899).*

Ore Handling and Treatment

In the mining of hard, low-grade iron ore, a new method of making vertical blast holes called fusion piercing has recently been tested on the Mesaba range, with increases in drilling speeds of ten times that of older methods.

In fusion piercing (developed by Linde Air Products Co.—R-900) a flame, produced by burning oxygen and a flux-bearing fuel in a rotating drill head, which is really a special blowpipe, is directed against the surface of the rock or ore. The high flame temperature—4000° F.—causes some kinds of rock to spall or flake off. Flux in the fuel causes other kinds of rock to melt. Pressure of the burning gases forces the molten material past a water spray where it is quenched and broken up. In the quenching process water turns to steam and the steam helps the gases force the quenched material out of the hole in the space surrounding the drill stem.

Screening ore to 65 mesh with minimum product of —200 mesh to increase metallurgical recovery has been accomplished in test work using welded wire surface screen made to Allis-Chalmers specifications (R-901). Reasonable capacity and efficiencies can be expected with freedom from blinding when making a separation to provide a product of less than 5% +65 mesh, with from 30 to 45% —200 mesh in the ultimate product.

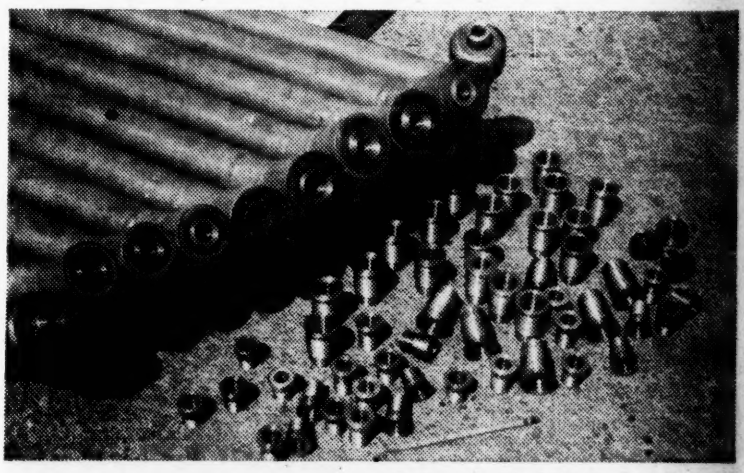
This is believed to be the first time a product of this fineness has been produced in closed-circuit grinding using a screen cloth or screen surface having a wire diameter in excess of 0.018 in. Freedom from blinding, long life and uniformity of product are ascribed to the perfectly rectangular shape of opening provided by the heavy wire as compared to woven wire screen cloth.

A new vibrating screen announced by Link-Belt Co. (R-902) is applicable to the sizing of iron ore, as well as openhearth and blast furnace slag, fluorspar, stone, and a wide variety of other materials. Known as the CA concentric-action screen, it can be had either floor mounted or suspended by spring and cable. An ingeniously balanced two-bearing vibrator machanism imparts a concentric or circular vibrating motion to all points of the screening surfaces. It is made with double or triple decks and in sizes ranging from 3x8 to 6x14 ft.

Construction of a 15-ton ore bridge for one of America's large steel mills was completed late in 1946 by Dravo Corp. (R-903). The bridge is the first such structure to have all-welded legs, trucks and trolley. Except for the main truss span and a few steel castings, all parts of the bridge are arc welded. The bridge has an over-all length of 575 ft. and is of the skew type. It can dig more than 900 tons per hr., taking ore from the receiving trough and dumping it on the center stock pile.

Oxygen for the Openhearth

The most important development in openhearth practice during the past year has been the use of oxygen for reducing meltdown time and decarburization time. A simple piece of equipment for introducing oxygen into the furnace is being marketed by Linde Air Products Co. as the jet device (R-904). It consists of a central oxygen supply pipe surrounded by two concentric water-cooled passages. The head of the device is equipped with a large number of replaceable nozzles of various sizes for oxygen flow rates of 3000 to 70,000 cu.ft. per hr.



Linde Jet Devices and an Assortment of Nozzles

In using oxygen to reduce the meltdown period, the jet device is inserted in a wicket hole of a charging door near the operating end burner. Oxygen is directed toward the preheated scrap at a pressure of 75 to 100 psi. and a flow rate ranging from 15,000 to 60,000 cu.ft. per hr. Rapid oxidation and melting require frequent adjustment of oxygen jet position for most effective performance. By this method, utilizing the self-sustaining combustion of the scrap to furnish heat, large craters about 7 ft. in diameter and 3 ft. deep can be melted readily in a relatively short time.

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*Further information about the equipment described may be secured by using the Reader Service Coupon on page 53, specifying the appropriate R-number, or by writing direct to the manufacturer at the address given on page 19.

Smelting of ores containing up to 13% TiO_2 in a blast furnace with a 19-in. hearth. Addition of alkali-bearing clays to the burden permitted smooth operation of the furnace with slags containing 15 to 20% TiO_2 and with ratios between CaO and SiO_2 of 1.2 to 1.25.

2-203. Sur la Reduction de l'Oxyde Titanique par le Calcium et par le Magnesium. (The Reduction of Titanic Oxide by Calcium and Magnesium.) Andre Chretien and Robert Wyss. *Comptes Rendus*, v. 224, June 9, 1947, p. 1642-1643.

Compacts of titanic oxide and finely divided metal (calcium or magnesium) were heated to 1200° for 2 hr. The oxide is reduced to pure titanium when calcium is used, and to TiO when magnesium is used.

2-204. Production of Alumina From Clay by a Modified Pedersen Process. T. P. Hignett. *Industrial and Engineering Chemistry*, v. 39, Aug. 1947, p. 1052-1060.

A lime-sinter modification of the Pedersen process for producing alumina from clay was investigated through operation of a pilot plant with a capacity of 300 lb. of alumina per day. Planning, organization, personnel requirements, operating techniques, collection of data, and chemical control; little emphasis on the process.

2-205. Fume and Dust in Lead Smelting. W. H. Dennis. *Mine & Quarry Engineering*, Aug. 1947, p. 237-242.

Recovery and collection of lead fume and dust.

2-206. Single Slag Basic Electric Heats. M. V. Healey. *Steel*, v. 121, Aug. 25, 1947, p. 104-107.

Process essentially consists of an adequate boil to eliminate the neutral and reducing gases, and then tapping the heat before the gases have an opportunity to return. Grain growth characteristics approaching those of basic openhearth steel are imparted.

2-207. Basic Openhearth Slag Control. Charles R. Funk. *Blast Furnace and Steel Plant*, v. 35, Aug. 1947, p. 939-943.

Functions of basic openhearth slags, the advantages and methods of slag control. (To be continued.)

2-208. The Use of Carbon in the Blast Furnace and Heat Balances. T. L. Joseph and Kurt Neustaetter. *Blast Furnace and Steel Plant*, v. 35, Aug. 1947, p. 944-948.

Purpose of a heat balance is to establish the amount of heat generated per unit of pig iron and to indicate the relative amount consumed in various phases of the process.

2-209. Use of Oxygen in the Openhearth Furnace. *Blast Furnace and Steel Plant*, v. 35, Aug. 1947, p. 949-956.

Construction and testing of a wide variety of special burners and oxygen injection devices, and the study of flame characteristics of burners.

2-210. German Practice in Refining Secondary Aluminum. James T. Kemp. *Light Metal Age*, v. 5, Aug. 1947, p. 8, 11-13.

Airplane scrap; sorting and separation on a sloping hearth; the Beck process; filtration; distillation; three-layer electrolytic process; Schmidt mercury process; Zincal process.

2-211. Dusting in the Copper Smelter. W. H. Dennis. *Mining Magazine*, v. 77, Aug. 1947, p. 78-80. (Concluded.)

Problem of converter dust and its recovery. A pipe-type electrostatic dust precipitator.

2-212. Copper Recovery From Low-Grade Waters. R. W. Toll. *Mining Magazine*, v. 77, Aug. 1947, p. 83-84.

Improved precipitation method in use at Devon Consols Mine has for several years averaged 70% copper.

2-213. Solving a Steel Production Problem. Arnold Hoffman. *Mining and Metallurgy*, v. 28, Sept. 1947, p. 444-446.

Advocates increased sinter production as a means of eliminating the dependence of the steel industry on scrap from outside sources.

2-214. Determination of Reactive Oxygen. *Journal of the Iron and Steel Institute*, v. 156, Aug. 1947, p. 526-528.

Sven Fornander discusses paper by I. M. Mackenzie (no. 2 issue, 1946). Results of carbon and oxygen determination on a few heats made in a basic openhearth furnace indicate that Schenck's formula is not reliable under those conditions. Author's comments.

2-215. Igniter Cuts Fuel Costs. L. M. P. Davison and C. M. Spencer. *Engineering and Mining Journal*, v. 148, Sept. 1947, p. 75-76.

New device for igniting the charge on the Dwight-Lloyd sintering machines in a lead smelter. A saving of 40% of the fuel cost is claimed.

2-216. Producing an Alloying Element of High Purity. W. L. Hammerquist. *Inco Magazine*, v. 21, Summer 1947, p. 24-26.

Equipment and methods used in the production of electrolytic manganese. Wide use is made of nickel and nickel alloys to defeat heat and corrosion.

2-217. Factors Affecting Basic Openhearth Operating Rates. Richard H. Ede. *Steel*, v. 121, Sept. 8, 1947, p. 94, 97, 100, 105.

Use of multiple correlation in obtaining answers to research problems is illustrated by an actual problem in steelmaking. Evaluation of three coefficients affords means of observing effect of feed ore on melt and tap carbons.

2-218. Electric Smelting. R. Durrer. *Iron and Steel*, v. 20, Aug. 1947, p. 389-390.

Possibilities of future development.

2-219. Oxygen-Enriched Blast. R. Durrer. *Iron and Steel*, v. 20, Aug. 1947, p. 390-391; discussion, p. 401-404.

Its use in production of iron and steel.

2-220. Oxygen. M. W. Thring. *Iron and Steel*, v. 20, Aug. 1947, p. 392-393; discussion, p. 401-404.

Possibilities of extended use in the British iron and steel industry.

2-221. New Process for Production of Pure Metallic Tungsten. Hans Bielstein. *Headquarters Air Materiel Command, Wright Field, Dayton, Ohio. Technical Report F-TR-1156-ND*, Aug. 1947, 6 p.

Process described differs from the usual method in two ways: the precipitated tungstic acid is dissolved in ammonia and paratungstate of ammonia is formed; and the paratungstate of ammonia is directly reduced by carbon. The purity of the product is claimed to be improved.

2-222. Vacuum Melting and Casting of Beryllium. A. R. Kaufmann and E. Gordon. *Metal Progress*, v. 52, Sept. 1947, p. 387-390.

Procedures developed for making sound castings which could be used as such or which could serve as extrusion billets. Composition of metal before and after vacuum fusion.

2-223. Economics of the Blast Furnace. B. S. Old, A. R. Almeida, R. W. Hyde and E. L. Pepper. *Iron Age*, v. 160, Sept. 18, 1947, p. 60-69.

Decreases in ore, coal, and coke quality have caused a 10% drop in blast-furnace productivity. Blast-furnace operation with high top pressure, and also operations combining this with beneficiated ores and oxygen-enriched blast should double the output of a furnace. 16 ref.

2-224. Great Lakes Relines Blast Furnace in 44 Days. *Iron Age*, v. 160, Sept. 18, 1947, p. 74-75.

Details of work schedule.

2-225. Phosphorus and Sulphur Equilibria Between Liquid Iron and Slag. *Metallurgia*, v. 36, Aug. 1947, p. 182.

Reviews papers by Winkler and Chipman, and by Grant and Chipman. (*Metals Technology*, v. 13, no. 3, 1946, T. P. 1987 and 1988.)

2-226. Reactions in the Acid Side-Blown Converter. Norman F. Dufty. *Metallurgia*, v. 36, Aug. 1947, p. 179-181.

Recent research and theoretical considerations of the resulting data explain the nature of reactions that occur.

2-227. Application of Slag Control and an Investigation of Basic Openhearth Slags. *Industrial Heating*, v. 14, Sept. 1947, p. 1472, 1474.

Reviews paper by T. Fairley presented before the British Iron and Steel Institute.

For additional annotations indexed in other sections, see: 4-122; 15-29; 27-179.

3 PROPERTIES OF METALS AND ALLOYS

3-263. A Metallurgical Investigation of a Large Forged Disk of Low-Carbon N-155 Alloy. J. W. Freeman and H. C. Cross. *National Advisory Committee for Aeronautics Wartime Report W-103*, Dec. 1945, 41 p.

The alloy contained 21.66% Cr, 19.40% Ni, 19.02% Co, 2.76% Mo, 1.90% W, 1.74% Mn, 0.79% Cb, 0.37% Si, 0.15% C, and 0.14% N_2, and was studied in the hot forged and stress-relieved condition by means of stress-rupture and creep tests for periods up to 2000 hr. at 1200, 1350, and 1500° F. Short-time tensile test, impact test, and time vs. total deformation characteristics.

3-264. Ductile, Brittle, and Boundary Cracks in Notched Impact Bars. D. M. Zagonodskikh. *Journal of Technical Physics (U.S.S.R.)*, v. 17, no. 3, 1947, p. 389-390. (In Russian.)

Ductile, brittle, and boundary cracks observed in fractured notched-impact specimens: The structural location and causes of each type of crack. Inclusions are believed responsible for brittle fracture and boundary cracks.

3-265. Expansion of Some Alloys During Crystallization. A. A. Bochvar, Z. A. Sviderskaia, and E. K. Korbut. *Bulletin of the Academy of Sciences of U.S.S.R. (Section of Technical Sciences)*, no. 4, 1947, p. 409-417. (In Russian.)

Many alloys (such as binary alloys of Cu-Zn, Cu-Sn, Al-Cu, and Al-Zn) exhibit initial expansion during solidification, preliminary to contraction which takes place upon further cooling. The extent of initial expansion has a direct relationship to the width of the liquidus-solidus zone. No measurable expansion of pure metals was observed.

3-266. On the Temperature Magnetic Hysteresis in Ferromagnetic Materials. J. S. Schur and V. I. Drozhina. *Comptes Rendus de l'Academie des Sciences de l'U.R.S.S.*, v. 56, no. 1, 1947, p. 39-42. (In English.)

Experiments on nickel and silicon steel (4% Si). Two causes of temperature magnetic hysteresis are difference in lattice structure and difference in magnetic structure. The second is emphasized since the first has already been studied in detail.

3-267. On the Notch Sensitivity of High-Strength Alloys. J. B. Friedmann and T. A. Volodina. *Comptes Rendus de l'Academie des Sciences de l'U.R.S.S.*, v. 55, no. 8, 1947, p. 743-746. (In English.)

The notch sensitivities of duralumin

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To reduce decarburization time, especially toward the end of refining, the jet device is usually placed in the furnace so that it is approximately 3 to 6 in. above the surface of the slag. The oxygen stream pushes the slag back and reacts with the metal below, causing violent agitation of the bath. While the injection continues, the rapid formation of large quantities of carbon monoxide causes the bath to boil and bubble over its entire surface. Heat input from the main burners is reduced from about one-half normal fuel flow at the start of oxygen injection to zero as the bath and furnace gain temperature. By the time a low carbon composition is reached, the bath is comparatively quiet.

Proper auxiliaries for the jet device require individual consideration in each mill. Consideration should be given to adequate oxygen and water supply, suitable orientation of the device inside the openhearth, convenience of installation for manual operation if required, and lack of interference with standard mill equipment such as cranes, charging buggies and charging machines.

The jet device can also be used in a similar way in the electric furnace to expedite both the melting and refining periods.

Compact and efficient oxygen generating equipment suitable for such use in steel plants (as well as for purposes requiring high purity oxygen, such as cutting and welding) is being made by Air Products, Inc. (R-905). Oxygen is produced by purifying and compressing air to operating pressure; drying, cooling and partially liquefying the air; distilling it into oxygen and nitrogen; and compressing the dry oxygen to the desired pressure. Oxygen is produced at purities of 99.5% and dew point of —292° F.

Six standard models are available in two series—the R series (R-200, R-750, and R-1250, with the number designating capacity in cubic feet per hour of compressed gaseous oxygen) and the E series (E-2000, E-5000, and E-10,000). A small and inexpensive pump in each generator compresses the oxygen to any desired pressure up to 2300 psi. The generators are easy to maintain and operate either intermittently or continuously from 30 to 60 days without defrost. Fast start-up time is another advantage, some models requiring as little as 3 hr. to be brought into production from room temperature, and as little as 1 hr. after an 8-hr. shutdown.

O. H. Furnace Doors and Burners

An All-Door front for openhearth furnaces made by Frazier-Simplex, Inc. (R-906) opens up so as to give access to the entire hearth area. Door frames, buckstays between doors and refractory door jambs are completely eliminated, and since the new door rolls instead of slides, the lining does not stick or rub on the lintel or door frame. Flanged truck wheels guide each door up and down in one plane. A two-point support makes the doors lean toward the furnace at all times. Water-cooled edges are not necessary, and the doors have a supported lining twice as thick as the conventional refractory door lining.

The Crowe Engineering Co. (R-907) is manufacturing a new artillery-type water-cooled burner for steel mill furnaces, equipped with adjustable atomizers for ejecting fuel in a fine spray. The resultant efficient combustion markedly decreases the time required for meltdown. The burner operates equally well with oil, or with pitch and gas combination; in fact, any liquid or gas fuel can be used. All artillery-type burners are made specifically for the furnace in which they are to be installed. They are easy to operate and can be raised or lowered and placed in position quickly.

Burner control and, in turn, combustion control of openhearth furnaces is brought to a higher degree of accuracy and efficiency by installation of a Viscorator (R-908), a continuous meter for viscosity measurement and control manufactured by Fischer & Porter Co. Burner control has customarily been predicated on the assumption that fuel oils have a constant viscosity at a given temperature. Since it has been found that fuel oil No. 6 varies from 38 to 160 SSF (Saybolt test for fuel and road oil) at 122° F., according to the source of supply, it is obvious that regulation on the basis of temperature control is inaccurate.

A modern battery of openhearth furnaces is equipped with common feeder and return manifolds for recirculation of the fuel oil, from the storage tank through a heat exchanger, the manifolds and back to the storage tanks. The purpose of this system is to feed the fuel oil as quickly as possible so that each furnace obtains the oil at the same temperature (and supposedly viscosity) and pressure.

It becomes a relatively simple matter to install a controlling Viscorator in this hydraulic system. It is only necessary to take a by-pass line downstream from the heat exchanger through the continuous viscosimeter and return it either to the return manifold or the storage tank. The same throttling valve on the steam line to the heat exchanger formerly employed for temperature control can be utilized for the viscosity control. Under this system, the steam admitted to the heat exchanger varies in accordance with the dictates of the viscosity controller to bring about a temperature change sufficient to maintain the predetermined oil viscosity.

Arc Furnaces and Controls

An improved electric furnace especially suitable for use in the gray iron foundry is one of the latest products of Pittsburgh Lectromelt Furnace Corp. (R-909). With poor grades of coke, pig iron and other raw materials, it is

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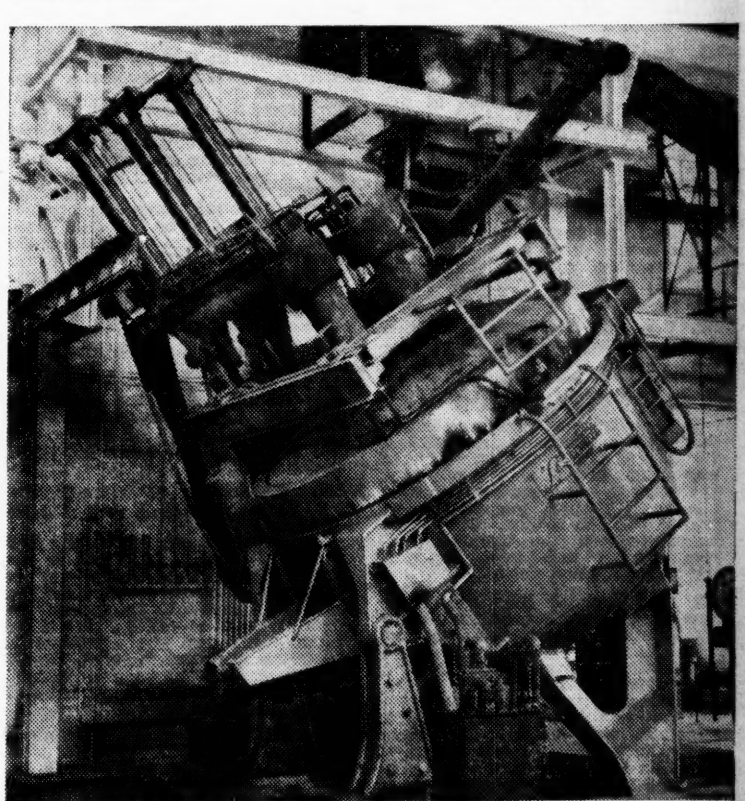


Pittsburgh Lectromelt Combination Melter and Duplexing Furnace

and high-strength aluminum alloy bars are investigated to find out whether the high notch sensitivity of alloy steels is a property of other alloys as well. Effects of different heat treatments. Notched aluminum-alloy specimens show diminishing ductility with increasing ultimate strength.

3-268. Some Experiments on Superconductivity at Radio-Frequencies. B. G. Lasarev, A. A. Galkin and V. I. Khotkevich. *Comptes Rendus de l'Academie des Sciences de l'U.R.S.S.*, v. 55, no. 9, 1947, p. 805-807. (In English.)

Tin and thallium wires 0.1 to 0.2 mm. in diameter were submitted to frequencies up to 2×10^7 cycles per sec. The time of relaxation for thallium at 2° K. is less than half the cycle for the highest frequency applied, that is, less than 2×10^{-8} sec.

3-269. Generalized Mechanical Properties of Solid Bodies. J. B. Friedmann. *Comptes Rendus de l'Academie des Sciences de l'U.R.S.S.*, v. 55, no. 9, 1947, p. 817-820. (In English.)

Relationships between mode of loading and flow and shearing strength curves for several metastable alloys. Generalized curves (which previously had been verified only for metals practically in an equilibrium state) are valid for duralumin, high-strength Al-Zn-Mg alloy, and austenitic 18-8 steels. 14 ref.

3-270. Recherches sur les Propriétés Elastiques des Métaux a l'Aide des Deux Pendules en Resonance d'Oberbeck. (Research on the Elastic Properties of Metals Using Two Pendulums in Oberbeck's Resonance.) Constantin Salceanu. *Comptes Rendus*, v. 224, June 23, 1947, p. 1756-1758.

Two pendulums bound together by wires of the different metals were used to determine their elastic properties. The increasing tension of each metal measured at definite intervals; torsion constant of the wires at constant tension.

3-271. Applications a la Mesure du Coefficient de Rigidité des Métaux de la Methode des Pendules de Resonance. (Applications of Measurements of the Coefficient of Rigidity of Metals Using Resonance Pendulums.) Constantin Salceanu. *Comptes Rendus*, v. 224, June 30, 1947, p. 1810-1811.

Further work on the resonance of two pendulums joined by metal wires. Relationship between the time measured and the coefficients of rigidity of the metals used. Data are useful in determining modifications in the elasticity of metals after heat treatment.

3-272. Resistance-Temperature Relation and Thermo-Electric Properties of Uranium. Andrew I. Dahl and Milton S. Van Dusen. *Journal of Research of the National Bureau of Standards*, v. 39, July 1947, p. 53-58.

The resistance-temperature relation showed sharp breaks at about 650 and 770° C., indicating the existence of transformation points. The very rapid change in resistance occurred at a somewhat higher temperature on heating than on cooling. Only slight irregularities in the thermo-electric properties were noted in the region of the transformation points.

3-273. Influence of Boron on Some Properties of Experimental and Commercial Steels. Thomas G. Digges and Fred M. Reinhart. *Journal of Research of the National Bureau of Standards*, v. 39, July 1947, p. 67-131.

Influence of simple and complex intensifiers on the cleanliness, structure, austenite, and McQuaid-Ehn grain sizes, hardenability, notch toughness at room and low temperatures and tensile properties of "split" heats of both experimental and commercial steels. Effects of deoxidation on these properties and the influence of boron on transformation temperatures and weldability and the recovery of boron on remelting. 27 ref.

3-274. Production Data Sheet. *Production Engineering & Management*, v. 20, Aug. 1947, p. 77.

Composition and properties of zinc alloys for die casting.

3-275. High Temperature Disk Forging Developments for Aircraft Gas Turbines. L. B. Fonda. *Steel Processing*, v. 33, Aug. 1947, p. 469-473, 486, 491, 500-502.

Type I-40 turbine wheel, with its buckets, comprises the high temperature rotating parts of the jet engine powering the P-80 airplane. Bursting tests on turbine wheel blanks and bucketed turbine wheels. Circumstances behind this investigation, the type of equipment used, the various alloys and forging practices investigated, and comparison of the results.

3-276. The Stainless Steels—Introductory. Lester F. Spencer. *Steel Processing*, v. 33, Aug. 1947, p. 474-478, 508.

Compositions in current use. Three principal classifications are alloys that contain chromium as the major alloying element (A.I.S.I. 400 series); alloys that contain both chromium and nickel (A.I.S.I. 300 series); and, alloys that contain other elements such as aluminum, tungsten, titanium.

3-277. Superalloys. Part I. Walter G. Hildorf. *Western Machinery and Steel World*, v. 38, Aug. 1947, p. 88-91.

Requirements for superalloys for high-temperature use in gas turbines. (To be continued.)

3-278. High Alloy Tool and Die Steels. Josef Bronner. *Machinery Lloyd (Overseas Edition)*, v. 19, Aug. 2, 1947, p. 103-106.

Properties of carbon, chromium, cobalt, manganese, molybdenum, nickel, silicon, tungsten, and vanadium toolsteels.

3-279. Internal Stresses Due to Anisotropic Thermal Expansion of Pure Metals and Alloys. W. Boas and R. W. K. Honeycombe. *Council for Scientific & Industrial Research, Melbourne, Australia, Serial No. A. 151, Physical Metallurgy Report No. 4*, May 6, 1947, 10 p.

Behavior of tin-base and lead-base bearings when subjected to repeated cycles of heating and cooling. Even after a very small number of cycles between 30 and 150° C. the tin-base bearings showed marked depressions on the surface. The lead-base bearings showed no signs of surface cracks even after 200 cycles. Experiments on pure metals showed that lead, aluminum, and magnesium were not deformed, while cadmium and zinc behaved similar to tin.

3-280. Thermal Disorder in Metals and Alloys. A. H. Cottrell. *Metal Treatment*, v. 14, Summer 1947, p. 93-102, 110.

An introduction to the methods of statistical thermodynamics, illustrating the wide range of problems to which these methods are applicable. 13 ref.

3-281. Probabilities of Magnetization. G. C. Richer. *Nature*, v. 160, Aug. 23, 1947, p. 256.

In an earlier analysis of the B-H curves of polycrystalline iron it was shown that a simple "trichotomy" of the steep part of the curves could lead to useful estimates of the quantitative distribution of operative lattice orientation along any given direction in polycrystalline sheet material. Results of subsequent work on this phenomenon and the build-up of the technical magnetization curve.

3-282. Ten New Magnetic Materials in Review. Alex E. Javitz. *Electrical Manufacturing*, v. 40, Sept. 1947, p. 74-78, 194, 196, 198, 200, 202, 204, 206, 208, 210.

Summary of available data on both "soft" and "hard" or permanent materials. Increasing flexibility of design possibilities offered. Data on Alnico not included.

3-283. Aluminum-Clad Light Alloys. *Engineering Materials and Processes*, v. 5, Aug. 1947, p. 90-91.

Composition and properties of the various British, American, German, Swiss, French, and Italian "Alclads", under their respective trade names.

3-284. Beryllium and Its Alloys. G. Fitz-Gerald-Lee. *Engineering Materials and Processes*, v. 5, Aug. 1947, p. 100-101.

Review of properties and applications.

3-285. A Study of the Relationship Between Resistance of Metals or Amorphous Bodies to Plastic Deformation and the Speed and Temperature of Deformation. L. D. Sokolov. *Journal of Technical Physics (U.S.S.R.)*, v. 17, no. 5, 1947, p. 543-548. (In Russian.)

Static and dynamic compression tests were made on cylindrical specimens of lead, tin, zinc, aluminum, copper, nickel, pitch, and glass at various temperatures; and true stresses were determined for various testing conditions.

3-286. The Electrical Resistance of Fe-Cr-C Alloys at High Temperatures. M. E. Blanter. *Journal of Technical Physics (U.S.S.R.)*, v. 17, no. 5, 1947, p. 549-556. (In Russian.)

A study of the electrical resistance of a series of chromium steels at temperatures ranging from 20 to 1200° C. Effects of variations in chromium and carbon in the austenitic as well as in the pearlitic state. An anomalous drop in electrical resistance upon transformation from pearlite to austenite and upon solution of excess carbides in the austenite was caused by the presence of the cubic carbide $(CrFe)_3C_6$. The solution temperatures of excess carbides depend on their crystal structure. 16 ref.

3-287. The Adiabatic Temperature Changes Accompanying the Magnetization of Cobalt in Low and Moderate Fields. L. F. Bates and A. S. Edmondson. *Proceedings of the Physical Society*, v. 59, May 1, 1947, p. 329-343.

The new method devised for the measurement of the small thermal changes which are associated with the step-by-step changes in the magnetization of ferromagnetic materials in fields not exceeding a few hundred oersteds was used in the study of annealed and unannealed cobalt in the form of heavy wire. The observed changes are relatively large and in striking contrast to those observed with iron and nickel. An attempt is made to explain them on the basis of modern concepts in ferromagnetism.

3-288. A New Cutting Alloy. L. Sanderson. *Machinery Lloyd (Overseas Edition)*, v. 19, Aug. 16, 1947, p. 95-97.

Properties and application of Tantung (45 to 50% Co; 27 to 32% Cr, 14 to 19% W, 2 to 7% Ta and Cb; 2 to 4% C; 2 to 5% Fe, and 1 to 3% Mn).

3-289. Thermal Conductivity of Aluminum; Solid and Liquid States. C. C. Bidwell and C. L. Hogan. *Journal of Applied Physics*, v. 18, Aug. 1947, p. 776-779.

An improved technique. The thermal conductivity decreases with rise of temperature as it does for lead, tin, and zinc.

3-290. Machine Design's Materials Work Sheet: Standard Steels. Wrought A.I.S.I. Types. Part I. *Machine Design*, v. 19, Sept. 1947, p. 157-167.

A condensed handbook-type presentation of information concerning general characteristics; fatigue strength; impact strength; wear resistance; properties as hot rolled and cold drawn; properties when hardened and tempered; tempered hardness to strength relationship; hardness obtainable; hardenability and its deter-

(Turn to page 14)

difficult to produce a uniform iron in the cupola alone. By putting the molten cupola iron through an electric furnace, the analysis can be readily adjusted to the desired point and at the same time the temperature can be raised to where all of the required molds can be poured without the necessity of pigging a surplus (an expedient taken when delays in the pouring line cause cupola metal to cool).

The new Lectromelt PT furnace is a fore-hearth unit which is actually a melting type of furnace, arranged with a substation to provide proper arc voltages for most efficient action as a duplex unit. In the top-charge type the roof can be raised and rotated for charging cold scrap. Molten metal additions can be made either through the pouring spout of the furnace or through the working door, which is diametrically opposite to the pouring spout. Latest improvements include oversized roof rings, four-point suspension of the electrodes, power-operated electrode holders, and nose tilt to insure minimum spout movement.

A new regulator for electric arc furnaces which is an automatic electrode positioning device has been developed by Westinghouse Electric Corp. and designated the Rototrol (R-910). Its function is to lower the electrode until it makes contact with the furnace charge, to position the electrode to produce the desired heat, and to maintain this heat at a constant value. Operation is automatic from the moment the furnace is charged and the circuit breaker closed.

The initial high inrush of current as the electrodes make contact with the charge is compensated by raising the electrodes; during meltdown, as the electrodes bore into the charge, heavy scrap may fall against them, causing another violent upswing in current that is also taken care of by electrode movement; and during the refining period, the electrode position must be continuously readjusted to allow for electrode consumption in the arc. The position controller, therefore, is in almost constant motion.

Westinghouse's Rototrol rotating regulator consists primarily of a static current and voltage responsive circuit and the Rototrol proper. The latter is a direct current generator, conventional in appearance and mechanical design, but having different electrical circuits, mainly additional field windings. It is designed to measure a number of electrical quantities and to supply an output in response to the quantities being measured. The measuring element is the field; the output element is the armature.

Induction Melting Equipment

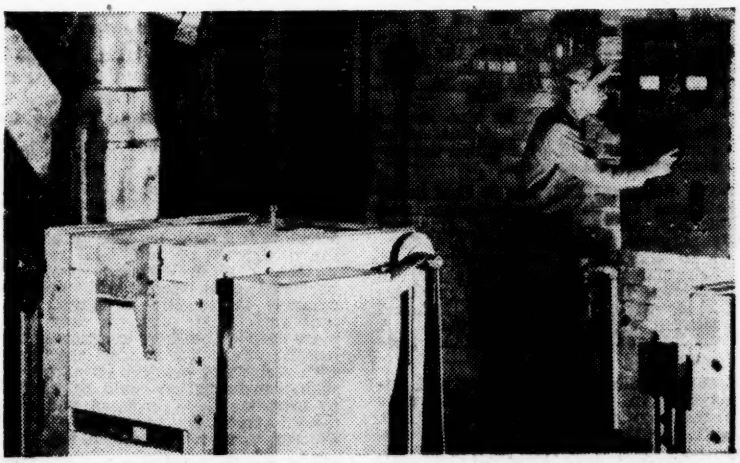
Production melting of high-grade alloy steels using mercury arc frequency converting equipment has been developed by Allis-Chalmers engineers (R-911) with the first electronic installation made during the past year at the Michiana Products Co., Michigan City, Ind. Subsequent installations have been made in other plants.

To operate electric induction melting furnaces of this type, power must be supplied to the water-cooled furnace coils at a frequency of about 1000 cycles. A 300-kw. mercury arc rectifier unit functions as a high-speed electronic switch in converting three-phase, 60-cycle power into single-phase, high-frequency power. Metal-clad a.c. switchgear and transformer equipment are also part of the installation.

The Michiana installation consists of two induction furnaces, each melting 650 lb. of steel. With full 300-kw. power applied, the melting time is about ¾ hr. Each furnace is factory-assembled and complete with built-in equipment for controlling tilting while pouring molten metal from the furnace.

For melting small quantities of steel (up to 30 lb.), a new 20-kw. Ajax-Northrup high-frequency converter has been announced by Ajax Electrothermic Corp. (R-912). Features are simple controls, safety interlocks and streamlined housing that completely encloses all parts into a semiportable unit measuring 44x44x58 in.

One convenient control knob adjusts the converter to the proper power output when connected to the melting furnace. The electrical circuit of the converter is self-tuning, with frequencies varying from 20,000 to 80,000 cycles per sec., depending on the size and shape of the furnace coil to which it is connected. The converter has specially tipped copper electrodes in the hydrogen-atmosphere, water-cooled spark gap chamber. To safeguard against damage to capacitor, spark gap or furnace coils, an interlocked alarm bell rings if the converter is turned on when the cooling water is not flowing properly.



Adjusting Electrical Power to an Induction Furnace During Melting of Alloy Steel. Allis-Chalmers mercury arc frequency converting equipment is in a substation behind the wall

Furnace Accessories

Positive and effective control of smoke and fumes from electric melting furnaces is provided by American Air Filter Co.'s furnace hood in combination with the Type N Roto-Clone (R-913). The hood confines the smoke and fumes at the source before they can disperse to adjacent working areas and exhausts them through a duct to a point of collection and disposal. The hood is circular and is attached to the furnace roof ring in such a way that it does not interfere with operation and maintenance. (See photo on page 15.)

The Roto-Clone maintains the necessary in-draft through the hood to prevent smoke and dust nuisance during the meltdown, boiling and refining stages. Air is cleaned by a water curtain induced by the flow of the air through the collector. It requires no moving parts, pumps, or other auxiliary equipment. Intricate sinuous passages create the centrifugal force for scrubbing the air and continuous precipitation of the dust.

Auto floor box chargers designed for plants where the expense of overhead or track-type charging machines is not justified are being manufactured by Edgar E. Brosius Co., Inc., with new modifications in design (R-914). A combination tongs and box charger ranges from 2000 to 20,000 lb. capacity. This machine requires no tracks or runways; a level floor is its only operating restriction. The head of the machine has an engaging mechanism so a box may be used in charging loose scrap. When charging baled scrap or pieces, the box is laid aside and tongs used. The machine can charge from a number of angles, permitting cross dumping or fan charging for equal distribution.

Another modification of Brosius floor chargers is designed for charging open-top electric melting furnaces. This machine is equipped with an open-end box and a pusher head. The charge can be accurately spotted, thus elimi-

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mination; applications of each type; fabrication; heat treatments; and corrosion resistance.

3-291. Surging of Valve Springs. *Automobile Engineer*, v. 37, July 1947, p. 265-270.

A critical survey of the literature on the failure of internal-combustion-engine valve springs.

3-292. Cobalt-Base and Nickel-Base Alloys for Ultrahigh Temperature. F. S. Badger, Jr., and F. C. Kroft, Jr. *Metal Progress*, v. 52, Sept. 1947, p. 394-402.

Correlates results of high-temperature tests on a number of alloys studied by various agencies for the National Defense Research Council, and used during the war for critical portions of high-temperature equipment, notably gas turbines for aircraft-engine superchargers and for main propulsion plants for high-speed airplanes.

3-293. Titanium in Type 405 Stainless Iron. George F. Comstock. *Metal Progress*, v. 52, Sept. 1947, p. 392-393.

Discussion of "Modified Type 405 Stainless Iron", by Merrill A. Scheil (July issue). Doubts that excess titanium caused embrittlement during service at 700 to 1000° F. If any of the ferrite-stabilizing elements (Cr, Mo, Al, Ti, or Cb) are present in amounts near the maximum permissible, a little of any other of them may cause embrittlement during service at these temperatures.

3-294. The Strength of Welded Joints at Low Temperatures and the Selection and Treatment of Steels Suitable for Welded Structures. Otto Graf. *Welding Journal*, v. 26, Sept. 1947, p. 508s-517s. Translated from the German.

Low temperatures (such as during the winter, or in contact with liquid air) have resulted in sudden failure of a number of welded structures. Development of satisfactory tests for steels to be used under these conditions, and recommended methods for production of satisfactory steels and for stress-relief heat treatment of structures. 16 ref.

For additional annotations indexed in other sections, see:
6-222-223-227; **27**-186-192-193.

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4 STRUCTURE — Metallography & Constitution

4-113. Interatomic Distances in Crystals and the Hume-Rothery Formula. F. S. Sarkissov. *Comptes Rendus de l'Academie des Sciences de l'U.R.S.S.*, v. 55, no. 8, 1947, p. 727-730. (In English.)

Hume-Rothery's generalization that the interatomic distances in crystals vary according to a periodic law. While Hume-Rothery confines himself to elements in subgroup A, the author establishes mathematical relationships for subgroup B.

4-114. An Investigation Into the Structure of the Nickel Skeleton Catalyst. G. G. Urazov, L. M. Kefely and S. L. Leichuk. *Comptes Rendus de l'Academie des Sciences de l'U.R.S.S.*, v. 55, no. 8, 1947, p. 735-738. (In English.)

A study made to determine whether changes take place in the lattice when Al atoms are removed from Ni_2Al_3 or whether the voids remain in place. It was found that the remaining nickel atoms rearrange to form a side-centered nickel lattice.

4-115. Kinetics of Grain Growth of Austenite in Boron Steels. S. M. Vinarov. *Comptes Rendus de l'Academie des Sciences de l'U.R.S.S.*, v. 55, no. 9, 1947, p. 809-811. (In English.)

Experiments were run with homogenized bars forged from a series of steels containing from 0.35 to 0.37% C and from 0.001 to 0.1% B. The bars were heated under different conditions, and their austenite grain size determined by cementation and oxidation methods and evaluated on the A.S.T.M. scale. It is concluded that grain growth of austenite is arrested by the formation of a monoatomic layer of boron, which is surface-active towards gamma-iron and lowers the free energy of the grains.

4-116. The Mutual Solid Solubility of Tungsten Carbide and Titanium Carbide. A. G. Metcalfe. *Journal of the Institute of Metals*, v. 73, June 1947, p. 591-607.

Structure and lattice parameters of tungsten carbide and titanium carbide investigated by the X-ray powder diffraction method. From results obtained up to 2800° C., a tentative equilibrium diagram has been drawn for the WC-TiC section of the ternary system Ti-W-C. 18 ref.

4-117. The Constitution of the Aluminum-Rich Aluminum-Cobalt-Nickel Alloys. G. V. Raynor. *Journal of the Institute of Metals*, v. 73, June 1947, p. 609-623.

Micrographic, thermal, and X-ray methods used. The general features of the constitutional diagram, and particularly the nature and extent of the solubility of nickel in Co_2Al_9, agree with predictions made on the basis of previous work, experimental and theoretical, on aluminum-iron-nickel alloys. 10 ref.

4-118. Sur les Equilibres du Système Plomb-Argent-Zinc au Voisinage de l'Eutectique Binaire, Riche en Plomb. (The Equilibrium of the Lead-Silver-Zinc System in the Vicinity of the Lead-Rich Binary Eutectic.) Leon Jollwet. *Comptes Rendus*, v. 224, June 30, 1947, p. 1826-1827.

Desilvering of lead by zinc in the lead-silver-zinc system. Oxidation of zinc is a source of error which the author attempted to avoid.

4-119. Selenium Additions to Cast Steel; Influence on Sulphide Inclusions and Ductility. Albert P. Gagnebin. *American Foundryman*, v. 12, Aug. 1947, p. 43-52.

In addition to refining the grain, selenium has the specific ability to coalesce the intergranular sulphides in low-oxide, well-killed cast steel, and thereby to improve its ductility. A theory for the mechanism of this phenomenon.

4-120. Stabilization, Tempering, and Relaxation in the Austenite-Martensite Transformation. J. H. Hollomon, L. D. Jaffe, and D. C. Buffum. *Journal of Applied Physics*, v. 18, Aug. 1947, p. 780-781.

Stabilization in the austenite-martensite reaction does not arise from tempering of martensite, but from stress relaxation. Apparently, the relaxation centers responsible for stabilization are produced by local plastic flow caused by austenite-martensite transformation and perhaps by non-uniform thermal contraction.

4-121. Hydrogen in Steel. J. H. Andrew, H. Lee, H. K. Lloyd, and N. Stephenson. *Iron and Steel*, v. 20, Aug. 1947, p. 397; discussion, p. 405.

A comprehensive study of the evolution of hydrogen from 22 different steels, hydrogen-soaked and cooled in vacuum under identical conditions.

4-122. Hydrogen in Steel Manufacture. C. Sykes, H. H. Burton, and C. C. Geggs. *Iron and Steel*, v. 20, Aug. 1947, p. 394-395; discussion, p. 405.

Determinations of the hydrogen content of plain carbon and alloy steels at different stages of manufacture indicate that ductility is reduced with hydrogen contents in excess of 2 cc. per 100 g. Even when steel is melted under carefully controlled conditions, hydrogen contents of 4 to 6 cc. per 100 g. are to be expected. Relatively high hydrogen contents do not automatically lead to hairline cracks. Data on permeability and solubility are used to calculate values for the diffusivity of hydrogen, making possible the prediction of the rate of loss of hydrogen from steels at temperatures down to 400° C., at relatively high hydrogen concentrations.

4-123. The Iron-Nitrogen System at High Pressures. I. R. Krichevskii and N. E. Khazanova. *Journal of Physical Chemistry (U.S.S.R.)*, v. 21, June 1947, p. 719-733. (In Russian.)

An investigation of this system from 350 to 525° C. and at pressures of 750 to 3770 atmospheres. The solubility of molecular nitrogen in iron is strongly influenced by pressure. At 750 atm. the solubility was only 0.04%; at 2300 atm. it increased to 0.33%. Preliminary oxidation of the surface of the specimen accelerated the penetration of nitrogen. 27 ref.

4-124. The Intermetallic Compound Phases of the System Aluminum-Manganese-Zinc. G. V. Raynor and D. W. Wakeman. *Proceedings of the Royal Society (Series A)*, v. 190, June 17, 1947, p. 82-101.

The system Al-Mn-Zn was examined in the range 0 to 95% Zn and 0 to 3% Mn. Phase diagrams and photographs of crystals. 12 ref.

4-125. X-Ray Reflections From Dilute Solid Solutions. K. Huang. *Proceedings of the Royal Society (Series A)*, v. 190, June 17, 1947, p. 102-117.

The effect on X-ray reflection of deviations of atoms from ideal lattice sites caused by the presence of randomly distributed foreign atoms in a dilute solid solution was investigated quantitatively. The theoretical formulas are applied to solid solutions of gold and copper.

4-126. Residual Stresses Caused by Grinding. L. A. Glikman and V. A. Stepanov. *Engineers' Digest (American Edition)*, v. 4, Aug. 1947, p. 378-379.

If the surface layer of the material is heated above the critical temperature then phase changes are bound to occur which may be responsible for the occurrence of additional residual surface stresses. Grinding tests on hardened steel pieces with preponderantly martensitic structure show that such phase changes may take place despite the short duration of the heating effect, but in steel specimens with sorbitic or pearlitic structure, no such transformation could be verified by experiment. (Translated and condensed from *Journal of Technical Physics*, v. 16, no. 7, 1946, p. 791-802.)

4-127. Graphite Formation in Gray Cast Iron. H. Morrogh and W. J. Williams. *Engineering*, v. 164, Aug. 8, 1947, p. 141-143; Aug. 15, 1947, p. 166-168.

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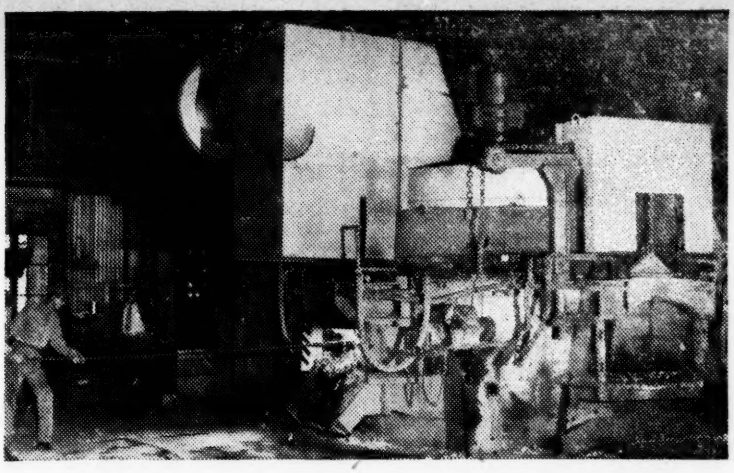


A.A.F. Furnace Hood Exhausted by Type N Roto-Clone Installed on 12-Ton Heroult Side-Charge Furnace

nating the danger of metal splash and damage to electrodes. A furnace leveling machine is another modification designed for electric furnaces where the charge is placed on the furnace apron by dump truck. The machine pushes the charge from the apron into the furnace and against the electrodes.

Blaw-Knox Co. has introduced a new type of reversing valve for small melting furnaces (R-915). Constructed with straight flow lines for the passage of the gases, the valve has only one moving part for complete reversal of air and waste gases. A swinging damper hollowed for the passage of air and turning about an axis central with the air port alternately connects the air intake port to each of two waste gas ports. The activating mechanism is mounted on the unit, thereby minimizing headroom requirements.

Refractories

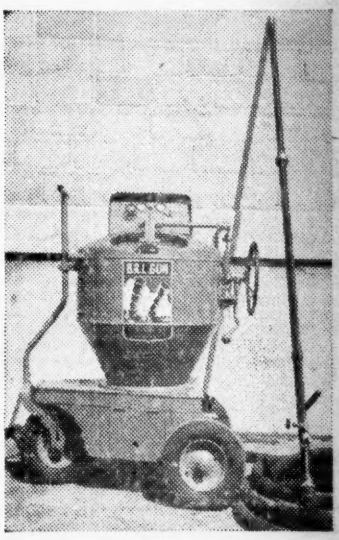
A rebuilt 122-ton openhearth furnace at the South Works of Carnegie-Illinois Steel Corp. (R-916) features the use of basic refractories for all parts of its masonry construction exposed to high temperatures, with the exception of the walls and roofs of the checker chambers, the checker brick, floors and bulkheads of the slag pockets, and the roofs of the fantails. Basic refractory brick and shapes used in building the masonry of the furnace were obtained from three independent sources and are of five kinds.

Designed as an experimental furnace for use under commercial conditions to determine the economic and metallurgical advantages obtainable from a basic lining, the furnace will also be used to study the application of oxygen as a combustion supplement. In addition it will provide an opportunity for comparing the characteristics of various kinds of refractories. Experiments will include the use of oxygen in different kinds of burners, and the use of preheated compressed air for atomization of oil. Studies will be made of flame radiation, effects on furnace efficiency of the higher temperatures permissible with basic linings, and of possible new steelmaking procedures.

Use of carbon block to reline a blast furnace in record time has been described by Great Lakes Steel Corp. National Carbon Co., Inc. (R-917) supplied the 445,200 lb. of block together with 84,800 lb. of carbonaceous packing and cementing material. The entire carbon bottom was installed in 32 hr., and the furnace was blown in just 44 days after the work started, less than half the time normally required for relining a blast furnace.

A new air-emplaced refractory utilizing Cuban chrome ore as a base, designed to facilitate the maintenance and repair of acid or basic brick openhearth furnace interiors, is being marketed by Basic Refractories, Inc., as Gunchrome (R-918). It is the second refractory product developed by the company's research laboratories for air emplacement, supplementing Gunmix which was placed on the market in 1942. Gunmix applied to electric furnace brickwork has increased side-wall lining life as much as 50%. It has been used more recently to line tapholes, to repair soaking pits, and hot-patch hearths in both the basic electric and openhearth.

Basic Refractories has also developed a new B.R.I. gun (R-919) which is equipped to wet the refractory shortly before the point of discharge and which has a discharge capacity of over 100 lb. per min. The gun has a hopper mounted on wheels which will hold, under pressure, 500 lb. of refractory weighing 140 lb. per cu.ft. An air jet sweeps the refractory from the shooting chamber through a standard 1¼-in. steel pipe, either straight or curved to reach all portions of the brickwork. The gun is equipped with valves and gages to control air feed to the hopper and the air jet.



Basic Refractories B.R.I. Gun for Applying Air-Emplaced Refractories

By using Gunmix or Gunchrome through the B.R.I. gun, speedy repairs can be made to portions of the furnace refractory superstructure which were hitherto either inaccessible or difficult to reach by conventional means.

A new air-setting refractory mortar called Armstrong's C-199 Cement (Armstrong Cork Co., R-920) is designed for use as a bonding mortar with firebrick and insulating firebrick. It is also recommended as a protective facing for firebrick furnace linings.

Excellent workability is an outstanding feature of C-199. It has high plasticity and can be troweled directly from the drum after many months of

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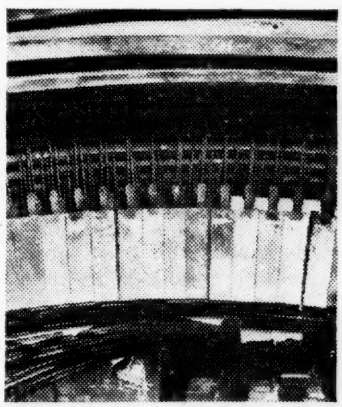

Main Roof Arch Construction in Carnegie-Illinois All-Basic Openhearth Furnace. Each of the metal hangers accommodates two tiles, which can be removed at any time without disturbing the remainder of the roof structure

An extensive and critical discussion of theories and experimental data available from the literature. Experimental results obtained by the authors. (Condensed from paper presented before Institute of British Foundrymen, Nottingham, England, June 17-20, 1947.)

4-128. Sheet Copper; Persistence of the Primary Solidification Structure. P. A. Jacquet. *Metal Industry*, v. 71, Aug. 22, 1947, p. 146-148.

Investigations of certain types of copper ingots characterized by very large crystals obtained by melting in vacuo and having a dendritic structure. 10 ref. (Translated and abstracted from *Métaux-Corrosion-Usure.*)

4-129. Proposed Experiments for Further Study of the Mechanism of Plastic Deformation. J. S. Koehler and F. Seitz. *Journal of Applied Mechanics*, v. 14 (*Transactions of the A.S.M.E.*, v. 69), Sept. 1947, p. A217-A224.

A qualitatively satisfactory theory is discussed and is then used to suggest worth-while experiments using single crystals in an attempt to simplify their interpretation. 28 ref.

4-130. Derivation of Stress, Strain, Temperature, Strain-Rate Relation for Plastic Deformation. J. D. Lubahn. *Journal of Applied Mechanics*, v. 14 (*Transactions of the A.S.M.E.*, v. 69), Sept. 1947, p. A229-A230.

The derivation and correction of an equation previously presented by J. H. Hollomon and the author.

4-131. Phosphorus-Deoxidized Copper Containing Bismuth. T. H. Schofield and F. W. Cuckow. *Engineering*, v. 164, Aug. 22, 1947, p. 190-191.

Previous investigations have shown that cold rolled nonarsenical phosphorus-deoxidized copper containing small quantities of bismuth is brittle at room temperature after quenching from 550°, but ductile after quenching from 750° C. The cause of this brittleness has not been established, but it is inferred that it may be due to intercrystalline films. Results of an electron microscope investigation to confirm the presence or absence of the films are somewhat inconclusive. (Condensed from "The Microstructure of Wrought Nonarsenical Phosphorus-Deoxidized Copper Containing Small Quantities of Bismuth," presented to Institute of Metals, London, May 22, 1947.)

4-132. X-Ray Diffraction Studies of Yielding in Mild Steel. E. W. Fell. *Nature*, v. 160, Aug. 23, 1947, p. 259.

Correlation between results reported by the author in 1927 and 1937 and those reported by Cowley and Paterson in a recent issue (v. 159, 1947, p. 846).

4-133. Residual Lattice Strains in Plastically Deformed Metals. G. B. Greenough. *Nature*, v. 160, Aug. 23, 1947, p. 258.

Experimental work shows that internal stresses arise mainly from plastic anisotropy of the metal and that the tensile stress required to cause glide in a given grain depends on the orientation of the glide planes and glide directions.

4-134. Reaction Between Molten Iron and Hydrogen Sulphide. *Journal of the Iron and Steel Institute*, v. 156, Aug. 1947, p. 528-530.

R. V. Riley discusses paper by James White and H. Skelly (Feb. issue), concerning a gray deposit resulting from the above reaction in silica combustion tubes. The authors' reply discusses at some length the theory that the material is SiS, formed by reaction of silica and sulphur.

4-135. As-Cast and Aged Structures of Cr-Co Alloys. *Metal Progress*, v. 52, Sept. 1947, p. 400B.

A series of 20 photomicrographs, covering four different aging times of five different alloys.

4-136. Graphitization of Steels at Elevated Temperatures. Albert E. White. *Metal Progress*, v. 52, Sept. 1947, p. 371-375.

A tendency for carbide to graphitize in steel pipe and fittings in high-pressure steam systems, discovered in 1943, has been combatted by specifying coarse-grained structure in the pipe—which prevents the steelmaker from deoxidizing the melt with aluminum, the greatest single promoter of instability of carbide—and by adding chromium to pipe, castings, and forged fittings for promoting stability of carbides.

4-137. Hexagonal Slip in Beryllium Crystal. Lester Tarnopol. *Metal Progress*, v. 52, Sept. 1947, p. 391.

Slip planes forming an excellent hexagon about a Brinell indentation in a beryllium single crystal.

For additional annotations indexed in other sections, see:
3-280-281-286; **6**-233-238; **11**-135-136; **25**-117; **27**-173-211.

136 brief digests covering all published developments in this field during 1946 appear in Vol. 3, ASM Review of Metal Literature. Vols. 1, 2 and 3 together give you three-year index to the metal industry. Each Vol. $10.00 to ASM Members. $15.00 to Nonmembers. American Society for Metals, 7301 Euclid Ave., Cleveland 3.

5 POWDER METALLURGY

5-58. Powder Metallurgy. Part III. Hard Metal Carbides. *Metal Industry*, v. 71, Aug. 8, 1947, p. 109.

General features of the method of manufacturing sintered carbides; mechanism of the process; theoretical principles.

5-59. Ford Utilizes Extrusion Method for Producing Metal Powder Gears. E. E. Ensign. *Automotive Industries*, v. 97, Aug. 15, 1947, p. 30-31, 72.

A method of producing metal powder parts at a lower cost and to closer tolerances than has been possible heretofore with conventional tools.

5-60. Furnace Atmospheres for Sintering. Part III. H. M. Webber and A. G. Hotchkiss. *Industrial Heating*, v. 14, Aug. 1947, p. 1254, 1256, 1258, 1260, 1262, 1264, 1266, 1268, 1270.

The atmosphere used in sintering metal-powder compacts must be such as to prevent any undesirable chemical reactions from taking place. Hydrogen, dissociated ammonia and partially burned fuel gas and means of purifying these. A few typical gas analyzers for detecting the purity. (To be continued.)

5-61. Powder Metallurgy; an Indexed Bibliography of the Literature. G. H. S. Price. *Metal Treatment*, v. 14, Summer 1947, p. 113-130.

210 additional references and subject and author indexes. (Concluded.)

5-62. Production Processes—Their Influence on Design. Part XXVII—Powder Metallurgy. Roger W. Bolz. *Machine Design*, v. 19, Sept. 1947, p. 139-146.

Design principles for items made by powder metallurgy. Typical average properties of powder metal parts from different metals and alloys and treated in different ways.

5-63. Symposium on Powder Metallurgy; Hard Metal Carbides. *Metallurgia*, v. 36, Aug. 1947, p. 197-199.

Reviews papers devoted to hard metal carbides, presented at recent meeting of Iron and Steel Institute (British).

For additional annotations indexed in other sections, see:
27-182-183.

SWEDISH IRON POWDERS
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6 CORROSION

6-222. Sur l'Oxydation de l'Aluminium a Haute Temperature. (The High-Temperature Oxidation of Aluminum.) Nicolas Cabrera and Jean Hamon. *Comptes Rendus*, v. 224, June 16, 1947, p. 1713-1715.

In studying the oxidation of aluminum at various temperatures, it was found that different methods had to be used below and above 200° due to the rapidly increased rate of oxidation at the higher temperatures. Formulas for estimating the electronic charge, according to Mott's theory of oxidation.

6-223. Sur l'Oxydation de l'Aluminium en Atmosphere Humide. (The Oxidation of Aluminum in a Humid Atmosphere.) Nicolas Cabrera and Jean Hamon. *Comptes Rendus*, v. 225, July 7, 1947, p. 59-61.

Plates coated wtih almost opaque layers of aluminum were oxidized in the presence of varying amounts of water vapor. A formula for estimating the thickness of oxidized Al takes into account that the amount of oxidation in moist atmospheres depends on pressure and does not agree with Mott's theory of oxidation in a dry atmosphere.

6-224. Corrosion Studies for the Petroleum Refining Industry. Part III. Corrosion Tests. F. A. Rohrman. *Petroleum Refiner*, v. 26, Aug. 1947, p. 109-113.

Corrosion testing and corrosion prevention. (Concluded.)

6-225. Copper Strip Corrosion Tests. John A. Bolt. *Petroleum Refiner*, v. 26, Aug. 1947, p. 118-120.

Tentative sets of corrosion standards for comparison and specification purposes.

6-226. Costs of Corrosion to the Water Industry. Harry E. Jordan. *Journal of the American Water Works Association*, v. 39, Aug. 1947, p. 773-778.

Cost according to size of industry, restoring capacity, cost of relining, and methods of reducing corrosivity.

6-227. The Corrosion of Metals. Part VIII. Aluminum and Its Alloys. *Sheet Metal Industries*, v. 24, Aug. 1947, p. 1633-1636.

The good corrosion resistance of

(Turn to page 18)

storage. It is easy to thin with water to dip joint or facing consistency. In the mortar box, C-199 remains in suspension even when thinned. Precision blending of the raw material particle size assures low shrinkage. In laboratory tests C-199 had a cold bonding strength over three times the 200 psi. required by A.S.T.M. specifications, a factor assuring a strong bond in the cooler portions of the wall as well as in the hot.

A castable refractory which withstands temperatures as high as 3000° F. and shows excellent stability and resistance to spalling under repeated heating and cooling cycles is known as Kaocast (R-921), a cement developed by the refractories division of Babcock & Wilcox Co. Other features are small volume change on initial firing and lack of shrinkage or expansion under continuous use at high temperatures. Kaocast can be either poured into place like ordinary concrete or used as a ramming mixture. Special shapes which were formerly made of kiln-fired materials or of refractory plastics can be readily fabricated from this material.

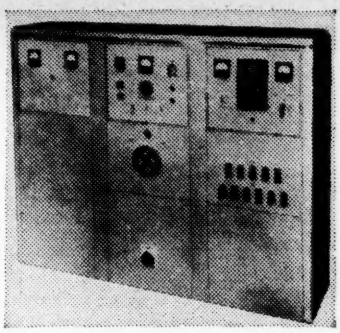
Eureka fire insulating brick made by Welding Equipment & Supply Co. (R-922) is about half the weight of a standard firebrick; dimensions are 2½x4x8 in. Porosity and lightness account for its exceptional insulating properties. The heat-holding properties of the mass of entrapped air cells that compose the brick can be demonstrated by holding the flame of an oxy-acetylene torch to the surface of the brick for half an hour; it can then be grasped in the hand within an inch of the surface on which the flame was played. It can be easily sawed and shaped with a carpenter's wood saw, and its lightness reduces labor and handling costs.

An adjustable conveyer cart with a clamping lever to hold material in place is a handy accessory for cutting intricate shapes and sizes from firebrick. It is a product of the Clipper Mfg. Co. (R-923), manufacturers of masonry saws. Brick up to 5 in. thick and 12 in. wide can be placed on the cart at the desired position and clamped in place at the proper angle for cutting.

The Steel Plant Laboratory

How a direct-reading spectrometer furnished by Baird Associates is affording faster and closer control in the melt shop is told by E. R. Vance, chief chemist of Timken Roller Bearing Co. (R-924). According to Mr. Vance, this installation is one of the first to be used for the analysis of steel.

Since the photographic stage of the process is replaced by direct photometric devices, the spectrum analysis plates, dark room, densitometer and calculation board are superfluous equipment. A quantitative analysis report for eight elements is obtained within 40 sec. after the sample has been placed in the electrode holders. Desired elements can be reported to the melt shop in from 5 to 6 min. after a test is taken. All preliminary and final tests from the melting department are handled by one man on each 8-hr. turn.



High-Precision Source Unit for Spectrochemical Analysis

Samples used for testing are steel pins, $\frac{7}{32}$ in. in diameter, cast on the end of a regular block test that is drilled for elements to be run in the chemical laboratory (carbon, phosphorus and sulphur). The pins are ground to a point, having an included angle of 135°, then placed in the electrode holders and the power turned on. A preburn period of 10 sec. is followed by an exposure of 16 sec. The emitted light passes through a lens and entrance slit and with the aid of a mirror is bent at an angle of approximately 45°, where it falls on the three-meter focal length grating, ruled 15,000 lines per in., which affords a dispersion of 2.8 Å per mm. for the spectral region of 2800 to 4400 Å in the second order.

The radiated light then passes through exit slits, one for each element, where it is reflected by a mirror onto the respective photomultiplier tube. These tubes generate a photocurrent, proportional to the amount of light striking them, which charges a condenser until the exposure is complete. The condensers are discharged through fixed resistors and a measurement is made of the ratio of the voltage of the unknown element condenser as compared to a standard iron condenser. An increase in sensitivity is obtained by passing the current through an amplifier circuit, one amplifier being used for each element. The time required to discharge the condensers is indicated on time clocks calibrated in percentage. The percentage of each element is transmitted by telautograph to the melting department.

The spectrometer has been calibrated for manganese (range 0.10 to 1.80%), silicon (0.01 to 1.50%), chromium (0.01 to 7.00%), nickel (0.01 to 5.00%), molybdenum (0.01 to 1.00%) and copper (0.01 to 0.50%). Calibrations are also being made for vanadium and tungsten.

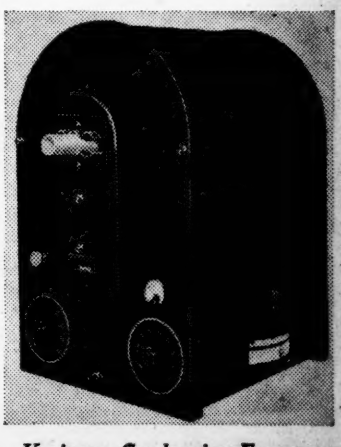
A source unit for spectrochemical analysis, placed on the market by Applied Research Laboratories last summer (R-925), is designed specifically for quantitative precision and accuracy, and has been tested by the direct reading quantometer. The unit provides two basic spectrum sources—high voltage and frequency for the higher percentage determinations, and low voltage and frequency for the lower percentages. Both sources have completely separate charge and discharge cycles, providing a high degree of reproducibility. The high-voltage source utilizes 240 spark trains per sec. of short duration for excellent sampling; the low-voltage source, 60 arc discharges per sec. of long duration for high sensitivity. A wide range of circuit constants can be furnished for any type of sample to be analyzed.

An improved Coleman spectrophotometer, Model 6A, has been announced by Wilkens-Anderson Co. (R-926). Using this equipment, E. A. Sobers of Milwaukee has developed a combined method for chemical analysis of iron or steel from a 1-g. sample. The procedure is described in a booklet available from the company.

A photoelectric colorimeter developed in the laboratories of one of the large alloy steel companies is being manufactured by the Will Corp. as the Kromatrol Photometer (R-927). A detailed methods manual for a number of elements in both ferrous and nonferrous alloys accompanies the Kromatrol. The instrument measures the transmittance or the per cent transmission of colored solutions; component parts are light source, filters, tube holder, photocell, sensitivity control, measuring circuit, galvanometer and potentiometer.

For carbon and sulphur determinations Harry W. Dietert Co. has made available the Varitemp combustion furnace with an electronic automatic temperature controller (R-928). Reproducibility of carbon and sulphur determination by the combustion method is improved by insuring that the samples are burned at an exact temperature; this the Varitemp does by maintaining any combustion temperature up to 2700° F. within 3%.

(Turn to page 19)



Varitemp Combustion Furnace

aluminum is surprising in view of its position in the electromotive series where it has a normal electrode potential of 1.33 volts, being more anodic than most of the common metals, such as copper, iron or lead. Aluminum has a high affinity for oxygen, and the natural oxide film formed on it is highly protective, both against further oxidation by the atmosphere and against attack by many other media. The protective properties of the oxide film on aluminum are exploited in the anodic oxidation processes.

6-228. Electrolytic Oxidation of Aluminum-Magnesium-Zinc Alloy Hy-43. O. Lohrmann. *Headquarters Air Materiel Command, Wright Field, Translation No. F-TS-1858-RE*, Aug. 1947, 19 p.

The aluminum-magnesium-zinc alloy Hy-43 is suitable for aircraft material with the addition of chromium. To increase its resistance against corrosion, Hy-43 is to be anodized.

6-229. Heavy-Metal Inserts and Corrosion. *Light Metals*, v. 10, Aug. 1947, p. 418-421.

Incidence and prevention of bimetallic corrosion provoked by various steel and copper-base elements in a magnesium casting alloy. The protective effect of the "Alrok" process for aluminum exposed to a similar hazard.

6-230. Use of Chromate Additions in Drilling Fluids. L. R. Jackson, H. M. Banta, R. C. McMaster and T. P. Nordin. *Drilling Contractor*, v. 3, Aug. 15, 1947, p. 77-82.

Laboratory tests and field observations on the use of sodium chromate additions in drilling fluids, to inhibit corrosion-fatigue damage of drill pipe.

6-231. Stress-Corrosion Cracking of Welded Mild Steel Gas Mains. *Engineering*, v. 164, Aug. 22, 1947, p. 186.

Present status of work being conducted by the British Welding Research Association.

6-232. Anodic Behavior of Mild Steel in Strongly Alkaline Solutions. Chas. D. Weir. *Nature*, v. 160, Aug. 23, 1947, p. 259.

Results of experiments.

6-233. Activation of Copper by Oxidation and Reduction. F. C. Aldred and F. Happey. *Nature*, v. 160, Aug. 23, 1947, p. 267-268.

Preliminary X-ray observations on the crystalline changes produced in the metallic and oxide films of copper during the activation process. A probable mechanism of activation is deduced from these results and those of Garner and Stone.

6-234. The Mechanism of Corrosion Fatigue of Steel in Acid Solution. M. Tchorabdji Simmad and U. R. Evans. *Journal of the Iron and Steel Institute*, v. 156, Aug. 1947, p. 531-539.

Corrosion fatigue in HCl shows certain analogies to, but also marked differences from, that in KCl. At the end of an incubation period, rounded pits develop into cracks, the residual strength sharply declines, the rate of chemical corrosion greatly increases, and the potential drops; these four changes occur sooner at high than at low stress ranges. A cathodic current can prevent detectable chemical attack but does not greatly increase life. The results are best explained by the changes produced by stress within the metal. 23 ref.

6-235. Six Methods for Controlling Corrosion Rates of Metals. H. H. Uhlig. *Industry and Power*, v. 53, Sept. 1947, p. 85-86.

Recently developed methods, possible applications, advantages, and limitations. (Based on paper published by American Chemical Society.)

6-236. The Chemical De-Scaling of Boilers. R. H. Burns. *Engineers' Digest (American Edition)*, v. 4, June 1947, p. 259-262.

Over 500 tests on various metals and alloys, using a variety of inhibitors and concentrations, are summarized and tabulated. Recommended cleaning procedures for large and small boilers; suggested control tests. 10 ref. (Condensed from *Journal of the Institution of Heating and Ventilating Engineers*, v. 14, Jan-Feb. 1947, p. 376-403.)

6-237. Heat Resistance. W. Stauffer and H. Kleiber. *Iron and Steel*, v. 20, Aug. 1947, p. 425-428; discussion, p. 407-409.

Resistance of well known heat resistant steels to chemical attack by air and by sulphur-bearing combustion gases. The investigations were carried out on the Escher-Wyss gas turbine at Zurich, the design of which is briefly described.

6-238. Effect of Carbide Structure on the Corrosion Resistance of Steel. R. W. Manuel. *Corrosion*, v. 3, Sept. 1947, p. 415-431; discussion, p. 431.

Much experience with oil-well and oil-pipeline corrosion indicates that the carbide structure of the steel has a great effect on corrosion resistance under conditions in which solid corrosion products form on the surface. Well-formed pearlite with lamellae which are long, straight, and continuous are definitely beneficial. Spheroidization of the pearlite removes this effect. Distortion by heating and alloying elements which affect the structure may also be harmful. (Presented at Annual Meeting of N.A.C.E., Chicago, April 7-10, 1947.)

6-239. Cathodic Protection of 138-KV. Lead Sheathed Power Cables of the Los Angeles Department of Water and Power. Irwin C. Dietze. *Corrosion*, v. 3, Sept. 1947, p. 432-442.

Development and installation of the system. (Presented at Annual Meeting of N.A.C.E., Chicago, April 7-10, 1947.)

6-240. Resistance of Aluminum Alloys to Fresh Waters. D. W. Sawyer and R. H. Brown. *Corrosion*, v. 3, Sept. 1947, p. 443-456.

Results of examination of piping, cooking utensils, and chemical process equipment, after service in contact with different types of natural water. Variations among the different aluminum alloys and Alclads are pointed out. (Presented at Annual Meeting of N.A.C.E., Chicago, April 7-10, 1947.) 13 ref.

6-241. Chemical Research and Corrosion Control: Some Recent Contributions of a Corrosion Research Group. W. H. J. Vernon. *Journal of the Society of Chemical Industry*, v. 66, May 1947, p. 137-142.

Work of the Corrosion Research Section of Chemical Research Laboratory, Department of Scientific and Industrial Research (England), since 1939. High-speed rotor apparatus for accelerated immersed corrosion tests; high-duty coatings; antifreeze solutions; corrosion inhibitors for use in heat exchange systems, de-icing systems, wrapping materials, enclosed air spaces; accelerated atmospheric corrosion tests; methods of pretreatment; bituminous coatings; microbiological (soil) corrosion; miscellaneous investigations and information services. 17 ref.

6-242. Preventing Corrosion in Gas-Condensate Wells. P. L. Menaul and P. P. Spafford. *Petroleum Technology*, v. 10, July 1947, T. P. 2229, 8 p.

The most dangerous form of corrosion encountered in condensate-well oil production, the discovery of the agent causing this corrosion, and the remedial chemical treatment proved effective by field use. The injection of NH_4OH has proved effective. The injection of "bone oil" is applied to wells producing brines containing Ca and Mg salts.

6-243. Statistical Analysis of Test Containers for Condensate Well Corrosion Studies. V. V. Kendall. *Corrosion*, v. 3, Aug. 1947, p. 359-366.

Two types of specimens were used in the study of corrosion in the flow lines of condensate wells—a washer-type mounted on a rod and a cylinder-type.

6-244. Corrosion in the Tropics. K. G. Compton. *Electrochemical Society Preprint 91-35*, 1947, 10 p.

Weather conditions in several tropical locations; change of relative humidity over the daily cycle. Zinc is particularly susceptible to corrosion by high humidity and condensation. Relative corrosion resistance of various metals.

6-245. An Attempt to Select a Suitable Specimen for the Study of Corrosion Cracking in 18-8 Steel. M. H. Springer, E. V. Succop, D. S. McKinney and M. A. Scheil. *Welding Journal*, v. 26, Sept. 1947, p. 530s-538s.

An extensive investigation of various types of test specimens, following a series of heat treatments. Corrosion cracking of austenitic stainless steels requires a rather critical combination of heat treatment, applied stress, and corroding environment. A program for recommended future research.

For additional annotations indexed in other sections, see: 18-184.

156 brief digests covering all published developments in this field during 1946 appear in Vol. 3, ASM Review of Metal Literature. Vols. 1, 2 and 3 together give you three-year index to the metal industry. Each Vol. $10.00 to ASM Members. $15.00 to Nonmembers. American Society for Metals, 7301 Euclid Ave., Cleveland 3.

7 CLEANING & FINISHING

7-335. Electropolishing Silver-Plated Parts in Cyanide Solutions. Daniel Gray and S. E. Eaton. *Materials & Methods*, v. 26, Aug. 1947, p. 78-81.

Technique of the process and some advantages.

7-336. Titanium-Bearing White Enamels in Shop Practice. Paul A. Huppert. *Ceramic Industry*, v. 49, Aug. 1947, p. 64-65.

Procedures, advantages and disadvantages, and possible sources of trouble.

7-337. There's More to Good Finishes Than Meets the Eye. *Electrical Manufacturing*, v. 40, Aug. 1947, p. 89-91, 214, 216, 218, 220.

The importance of proper pretreatment of metallic surfaces before applying paints or other finishes. (Limited to phosphate-type compounds.)

7-338. The Alumilite Process. R. H. Petit. *Modern Metals*, v. 3, Aug. 1947, p. 16-18.

Aluminum coatings—particularly those offering protection against corrosion. Process offers a wide variety of colors in addition to a good paint base and a protective coating. Smudging or staining is also prevented.

7-339. The Self-Opacification of Titanium Enamels; an Account of Some Recent Investigations. W. H. F. Tickle. *Sheet Metal Industries*, v. 24, Aug. 1947, p. 1627-1632.

Yellowing of second coat applications; the physical form of titanium dioxide used; effect of adding ferric oxide to the mill; improvement of color index; the theory of iron-oxide effect; X-ray powder diagrams of titanium frits. (Concluded.)

(Turn to page 20)

New Compositions and Properties

Four new deep hardening carburizing steels under the name U.S.S. SuperKore were announced in June by Carnegie-Illinois Steel Corp. (R-929). Based on wartime experience, a special melting practice was developed to make the most effective use of lower alloy content and at the same time improve the carburizing, annealing and machining characteristics of these steels for heavy duty applications in such parts as gears, shafts and pinions in airplane, truck and bus service.

SuperKore A and AA have hardenability equal to or, slightly greater than the A.I.S.I. 3300 or 9300 steels of similar carbon content; other physical properties are comparable, and carburizing characteristics are better than the 3300 or 9300 types, with decreased amounts of retained austenite and massive carbides.

SuperKore B corresponds to the A.I.S.I. 4800 steels of similar carbon content; it has satisfactory machinability when properly heat treated. SuperKore C has hardenability and physical properties equal or superior to the 4300 steels of similar carbon content. Carburizing characteristics are improved and machinability and heat treatment are the same as for the B grade.

A new process for the manufacture of specialized alloy steels announced by the M. W. Kellogg Co. (R-930) is essentially an electric ingot method of continuous casting. Alloying elements are fed continuously at a controlled rate into an electrical apparatus from which air is excluded; ingots are produced by progressive solidification. Although there is no limit to the length of ingot that can be cast, the ingots now made vary between 6 in. and 6 ft. so they may be charged into existing heating furnaces.

The method is particularly adapted to the production of quality steels for high temperature resistance (1500° F. and higher), high speed toolsteels, and free-machining stainless steels. Progressive solidification insures uniformity not only of chemical analysis but also of physical properties. Segregated areas in the center of ingots, internal bursts, segregated carbides and piping are defects which the new process is said to eliminate. Another marked improvement is in ductility of the steel; turbine wheels fabricated of a high-temperature alloy by conventional methods had an elongation on the order of 2%; test wheels made of the same alloy fabricated by the Kellogg method had an elongation of more than 20%.

Production of Hi-Steel, a relatively new development of Inland Steel Co. (R-931), has been substantially increased with the licensing during the past year of a number of additional companies to manufacture the product. Hi-Steel is a low-alloy structural steel used extensively by railroads and in other structural applications demanding light weight, high strength and corrosion resistance.

In addition to nickel and a small amount of phosphorus, Hi-Steel contains five times as much copper as the conventional copper-bearing steel, and consequently has about twice the corrosion resistance. It can be cut, punched, reamed, formed, and is easily welded by arc, spot, resistance, or flash methods. Yield point is approximately 55,000 psi. (about double that of carbon structural steel). By a simple heat treatment this yield point can be increased to as high as 85,000 psi.

A new and improved set of Matched Toolsteels has been developed by Carpenter Steel Co. (R-932). The 12 steels that make up the complete Matched Set are so interrelated that each takes up the work where the other leaves off, simplifying the selection of the right steel for each job, increasing production and lowering costs.

Three air hardening steels have been added to the Matched Set, one for optimum wear resistance with good toughness, one with a balanced combination of wear resistance and toughness, and the third with optimum toughness and good wear resistance. Two new members have been placed in the red-hard division, both being harder and tougher than previous steels. The oil hardening and water hardening matched sets remain unchanged.

Stainless steel powder is a 1946 development for which new uses are constantly being found. The latest product is a stainless steel flake powder for the paint and coatings industry just announced by Charles Hardy, Inc. (R-933).

Low-carbon 18-8 stainless steel is reduced to flakes of microscopic size for application to surfaces in much the same manner as aluminum and bronze flake in the paint industry. To facilitate addition to most commercial vehicles such as spar varnish, cellulose lacquer and other coatings, approximately 10 to 12% Varsol is added to make a paste; to improve leafing characteristics the paste contains approximately 2% stearic acid. For special applications such as corrosion resistant lettering, lithography and for use with special vehicles, a dry flake substantially free of Varsol is available.

Other uses for stainless steel powder are for the fabrication of corrosion resistant bearings, gears, pump rotors, bushings, nozzle parts and cams.

The powder compacts readily at 30 tons per sq.in., sinters nicely in dry hydrogen or cracked ammonia, and represses easily. After annealing, tensile strengths of 55,000 psi. and elongation of 25% in 1 in. have been attained. Higher compacting pressures will result in better physical properties if required.

Addresses of Manufacturers

Air Products, Inc. (R-905)
Emmaus, Pa.

Ajax Electrothermic Corp. (R-912)
Trenton 5, N. J.

Allis-Chalmers Mfg. Co. (R-901, 911)
Milwaukee 1, Wis.

American Air Filter Co., Inc. (R-913)
First and Central Ave.
Louisville 8, Ky.

Applied Research Laboratories (R-925)
7707 Michigan Ave.
Detroit 10, Mich.

Armstrong Cork Co. (R-920)
Lancaster, Pa.

Babcock & Wilcox Co. (R-921)
Refractories Division
85 Liberty St.
New York 6, N. Y.

Basic Refractories, Inc. (R-918, 919)
845 Hanna Bldg.
Cleveland 15, Ohio

Blaw-Knox Co. (R-915)
2042 Farmers Bank Bldg.
Pittsburgh 1, Pa.

Brosius Co., Inc., Edgar E. (R-914)
Sharpsburg, Pa.

Carnegie-Illinois Steel Corp. (R-916)
208 South LaSalle St.
Chicago 90, Ill.

Carnegie-Illinois Steel Corp. (R-929)
429 Fourth Ave.
Pittsburgh 19, Pa.

Carpenter Steel Co. (R-932)
Reading, Pa.

Clipper Mfg. Co. (R-923)
2800 Warwick
Kansas City 8, Mo.

Crowe Engineering Co. (R-907)
Elmwood Place
Cincinnati, Ohio

Dietert Co., Harry W. (R-928)
9330 Roselawn Ave.
Detroit 4, Mich.

Dravo Corp. (R-903)
4801 Neville Island
Pittsburgh 25, Pa.

Fischer & Porter Co. (R-908)
Hatboro, Pa.

Frazier-Simplex, Inc. (R-906)
432 East Beau St.
Washington, Pa.

General Electric Co. (R-899)
Schenectady 5, N. Y.

Hardy, Inc., Charles (R-933)
420 Lexington Ave.
New York 17, N. Y.

Inland Steel Co. (R-931)
38 South Dearborn St.
Chicago 3, Ill.

Kellogg Co., M. W. (R-930)
Jersey City, N. J.

Linde Air Products Co. (R-900, 904)
30 East 42nd St.
New York 17, N. Y.

Link-Belt Co. (R-902)
307 North Michigan Ave.
Chicago 1, Ill.

National Carbon Co., Inc. (R-917)
Niagara Falls, N. Y.

Pittsburgh Lectromelt Furnace Corp.
P. O. Box 1257 (R-909)
Pittsburgh, Pa.

Timken Roller Bearing Co. (R-924)
Canton 6, Ohio

Welding Equipment & Supply Co.
223 Leib St. (R-922)
Detroit 7, Mich.

Westinghouse Electric Corp. (R-910)
East Pittsburgh, Pa.

Wilkens-Anderson Co. (R-926)
111 North Canal St.
Chicago 6, Ill.

Will Corp. (R-927)
Rochester 3, N. Y.

-340. Liquid Honing; Further Developments in Vapor Blast. *C. A. Prince. Machinery Lloyd (Overseas Edition),* v. 19, Aug. 2, 1947, p. 68-69.

Liquid honing is a surface cleaning deburring and finishing method based on the use of a fine abrasive mixed with a chemical emulsion discharged by compressed air against the surface to be treated. Industrial applications.

7-341. Offset Machines Produce Wood Grain on Steel. Herbert Chase. *Iron Age,* v. 160, Aug. 21, 1947, p. 80-84.

Procedure and equipment used at Fisher Body. Considerable savings result from the substitution of this finish for the decals previously used.

7-342. Porcelain Coats on Metal Bases. Edward Mackasek. *Scientific American,* v. 177, Sept. 1947, p. 106-109.

Development of thinner, more resistant coatings which will impove countless products for both home and industry.

7-343. The Nature of Enamel Adherence. R. M. King. *Mining Magazine,* v. 77, Aug. 1947, p. 37-39, 56.

General theory of adherence; glass-to-metal seals; "oxide" theory; "dendrite" theory; the ferrous phase; etched surface theory; and adherence and coefficient of expansion.

7-344. Spray-On Zinc Coating Methods. Ivor Richards. *Organic Finishing,* v. 8, Aug. 1947, p. 30-33, 36-38.

Wire and powder metallizing. Hot dipping compared with zinc spraying.

7-345. Plastic Coatings to Control Metal Corrosion. S. P. Wilson. *Organic Finishing,* v. 8, Aug. 1947, p. 39-42.

Thermosetting and thermoplastic materials and uses and selection for various purposes. (To be continued.)

7-346. Obstacles in Cleaning Drawing Compounds From Enameling Iron. W. H. Pfeiffer and V. A. Williamitis. *Enamelist,* v. 24, Aug. 1947, p. 18-24.

Under certain conditions of storage, some drawing compounds (die lubricants) form or deposit a material on the surface of sheet enameling-iron parts which is insoluble in water and alkaline cleaners but is made soluble by organic solvents. Remedies offered. Test method should aid in the development of improved drawing compounds and more effective cleaning methods.

7-347. Modern Wire Pickling Practice and Plant Design. Part IV. Acid Recovery Systems. Edward Mulcahy. *Wire Industry,* v. 14, Aug. 1947, p. 441-442.

Methods of recovery of acid with advantages and economics of each.

7-348. Continuous Galvanizing. A. D. Stout, Jr. *Iron Age,* v. 160, Aug. 28, 1947, p. 79-80.

A continuous pipe galvanizing process, capable of coating up to 600 tons of 2-in. pipe every 24 hr., is said to produce zinc-coated tubular products having smoothness, luster and uniformity of coat superior to that produced by earlier batch-type galvanizing methods.

7-349. Spra-Bonderizing. *Automobile Engineer,* v. 37, Aug. 1947, p. 313-314.

Production line for continuous application of this coating to body parts in British automobile factory.

7-350. Discussion of Paper on Outdoor Exposure of Filled Asphalt Coatings. Milton R. Beasley. *ASTM Bulletin,* Aug. 1947, p. 86.

Effects of filling on asphalt coatings for metal shown photographically. Author's reply by G. L. Oliensis.

7-351. Measurement of Metal Polish Performance. Frank E. Clarke and Robert C. Adams. *ASTM Bulletin,* Aug. 1947, p. 57-62.

Equipment and procedures for evaluating the performance characteristics of polishes used for brightening decorative metal work. Development of a polishing machine, a tarnishing procedure, and a polishing procedure. Tests for abrasion, caking, flammability, poisonous constituents, and reaction; tests for evaluation of silver polishes.

7-352. Metal Protection by Metal Powder. *Machinery Lloyd (Overseas Edition),* v. 19, Aug. 16, 1947, p. 99-100.

Schori powder spraying process.

7-353. Vehicle Paint Job Success Keyed to Surface Treatment. *SAE Journal,* v. 55, Sept. 1947, p. 57-58.

Photographs of exposure panels show effects of several different types of treatment. (Digest of "Metal Treatments Prior to Painting", by Van M. Darsey.)

7-354. How to Select Coatings for Aluminum. Ray Swan and N. P. Ruther. *Canadian Metals & Metallurgical Industries,* v. 10, Aug. 1947, p. 23, 40-41.

Recommendations for various types of base material and for different applications.

7-355. Metal Sprayed With Molten Porcelain Enamel. Duncan C. Pell. *Ceramic Industry,* v. 49, Sept. 1947, p. 65, 67.

New type of air-pressure blowgun, used by the Army and Navy to coat water tanks, which finishes metal surfaces with molten glass, metals, or plastics.

7-356. Tin Saving in the Turbine Works of a Cast Iron Foundry. V. I. Smirnov. *Boiler and Turbine Manufacture (U.S.S.R.),* April 1947, p. 27-28. (In Russian.)

Wartime experiments on the practicability of various metals as substitutes for tin in the coating of cast iron. Good results were obtained by dip coating with zinc and also by application of aluminum paint.

7-357. Hot Dip Galvanizing; Analytical Methods for Routine Control. F. F. Pollak and E. F. Pellowe. *Metal Industry,* v. 71, Aug. 22, 1947, p. 143-145.

The adaptation of existing methods of analysis for rapid routine control.

7-358. De-Enameling Process. *Stove Builder,* v. 12, Sept. 1947, p. 48-49.

A commercial de-enameling process and layout.

7-359. Chemical Finishing of Metals. F. P. Heard. *Monthly Review,* v. 34, Sept. 1947, p. 1035-1042.

Chemical finishing means the conversion of the surface layer of a metal article from its metallic state to a chemical compound of that metal by chemical means. Oxide coatings on ferrous metals; other processes for steel; black oxide coatings on copper alloys; phosphate coatings on ferrous and nonferrous metals.

7-360. Survey of the Cleaning Methods Used for Iron and Steel Surfaces. Rick Mansell. *American Paint Journal,* v. 31, Sept. 1, 1947, p. 54, 56, 60.

Solvent cleaners, steam cleaning, phosphoric acid cleaners, vapor degreasing, alkaline cleaners, and electrolytic cleaners.

7-361. Synthetic Finishing Operations at Philco. Herbert Chase. *Products Finishing,* v. 11, Sept. 1947, p. 24-26, 28, 30.

Procedures and equipment used in finishing of radio parts.

7-362. Racks for Finished Parts. John E. Hyler. *Products Finishing,* v. 11, Sept. 1947, p. 34, 36.

Design of racks used in supporting various shapes and sizes of metal parts that have been freshly sprayed or dipped.

7-363. Barrel Finishing of Metal Products. Part 13—Barrel Finishing Procedure and Its Relation to Porosity of Electrodeposited Surfaces. H. Leroy Beaver. *Products Finishing,* v. 11, Sept. 1947, p. 38, 40, 42, 44, 46, 48, 50.

A general discussion.

7-364. Electroless Plating on Metals by Chemical Reduction. *Products Finishing,* v. 11, Sept. 1947, p. 54-56, 58.

Method developed by the National Bureau of Standards.

7-365. Fishtails—an Old Buffing Problem. T. R. Treadwell. *Metal Finishing,* v. 45, Sept. 1947, p. 68-70.

Definition and causes for this buffing fault; a series of corrective measures.

7-366. Factors to Consider in Hot Dip Galvanizing. A. D. Wilcox. *Industrial Heating,* v. 14, Sept. 1947, p. 1426-1428, 1430, 1458.

The process, with special reference to the use of gas as fuel for firing kettles. (Based on paper presented before Midwest Industrial Gas Council.)

For additional annotations indexed in other sections, see:
8-137-138; **14**-238; **27**-187-203.

399 brief digests covering all published developments in this field during 1946 appear in Vol. 3, ASM Review of Metal Literature. Vols. 1, 2 and 3 together give you three-year index to the metal industry. Each Vol. $10.00 to ASM Members. $15.00 to Nonmembers. American Society for Metals, 7301 Euclid Ave., Cleveland 3.

8 ELECTROPLATING

8-127. Elektroplatering i Teori och Praktik. (Electroplating in Theory and Practice.) Part II. *Finish (Sweden),* v. 4, April 1947, p. 75-78.

Electroplating practices and theory in countries outside of Sweden.

8-128. Treatment Works for Plating Wastes Containing Toxic Metals and Cyanides. George E. Barnes. *Water & Sewage Works,* v. 94, Aug. 1947, p. 267-271.

Processes and plants for treating the plating wastes from Talon, Inc. Starting with simple provision for neutralizing the spent pickling liquors with lime, improvements were begun to remove cyanides and chromium along with other toxic metals such as copper and nickel. A new multipurpose treatment works for complete treatment of all the wastes.

8-129. Periodic Reverse Current Electroplating. George W. Jernstedt. *Steel Processing,* v. 33, Aug. 1947, p. 479-482, 498.

Polishing costs are reduced and the plated deposit shows superior qualities of strength, elasticity, density, and freedom from flaws such as porosity.

8-130. Filtration of Electroplating Solutions. S. Alsop, Jr. *Asbestos,* v. 29, Aug. 1947, p. 4, 6, 8.

The introduction of bright finishes, automatic plating machines, high speed processes and higher current densities, to deposit more metal faster during the plating process, makes filtering an important consideration. Plating plants are now using asbestos filter pads to remove the sludge which is formed by the dissolving of the electrodes, plus solids thrown out of solution in the water and plating chemicals, in addition to dust, dirt, and oil from the surrounding air, and contamination from the products to be plated.

8-131. Electroless Plating on Metals by Chemical Reduction. *Chemical Age,* v. 57, Aug. 2, 1947, p. 156-157. Also *Western Metals,* v. 5, Aug. 1947, p. 38-39.

A new method for plating nickel and cobalt on metal surfaces without

(Turn to page 22)

Recrystallization And Grain Growth Studied in Brass

Reported by George L. Barnard
Metallurgist
Los Alamos Scientific Laboratory

Describing the general purpose of the rather recently formed Institute for the Study of Metals of the University of Chicago, its director, Cyril S. Smith, pointed out that work will be done in the field between metallurgy and physical chemistry; there will be a correlation between physicists, metallurgists and chemists. Dr. Smith addressed the Los Alamos Chapter ⓐ on Aug. 19; his main topic was recrystallization and grain growth.

Most of the work has been done on brass by one of the Institute members, Dr. J. E. Burke. Dr. Smith, in talking about grain boundary migration, said that a variation of surface energy or other factor with grain boundary curvature seemed to be more important than differential strain and grain size contrast which had hitherto been regarded as factors of greatest importance. Smith described a model of a soap froth in a near vacuum which shows growth of the individual cells in a manner geometrically almost identical with grain growth in metals, although the actual mechanism must be quite different.

Dr. Ke at the Institute has shown that, in polycrystalline metals, grain boundaries behave under stress as if they were a thin layer of viscous material. Slides were shown relating internal friction and relaxation of stress or strain with temperature in support of this fact.

Dr. Smith discussed Zener's work on internal friction and showed that there are many causes of mechanical relaxation, including the relocation of both interstitial and substitutional solute atoms, the migration of grain boundaries in tetragonal materials of axial ratio very close to one, in addition to the better known relaxation due to intercrystalline thermal currents and intercrystalline grain boundary yielding.

Speaks on Metal Cutting

Reported by W. R. Jackson
Carboloy Division
Canadian General Electric Co., Ltd.

Recent developments in carbide metal cutting theory and practice were reviewed at the first fall meeting of the Ontario Chapter ⓐ by Michael Field of the Cincinnati Milling Machine Co. Mr. Field also outlined the fundamental factors involved in the machinability of metals.

The lecture was well illustrated with lantern slides and motion pictures, including close-up pictures of chip formation, with both positive and negative rake cutters. The large gathering took an active interest in the question and answer period at the close of Mr. Field's address.

Lincoln Welding Award Program Is Resumed

The trustees of the James F. Lincoln Arc Welding Foundation have announced the rules of their Annual Engineering Undergraduate Award and Scholarship Program. This program started in 1942 but was interrupted by the war.

The program contains two interdependent plans: the award plan and the scholarship plan. Under the award plan, students of various engineering schools and colleges will submit papers on arc welded design and the use of welding in maintenance of machines and structures. Under the scholarship plan, scholarships will be allocated to the schools in which the three highest award recipients under the award program are registered. Awards for papers will total $5000, and the total amount of scholarship funds will be $1750.

Copy of the Rules and Conditions may be obtained by writing the James F. Lincoln Arc Welding Foundation, Cleveland 1, Ohio.

Permanente Opens New Lab

One of the largest technical laboratories devoted exclusively to aluminum fabricated products has been established by Permanente Metals Corp. adjacent to the Trentwood Rolling Mills at Spokane, Wash. The laboratory will be headed by Paul Zeigler, who joined the corporation in 1946 as chief metallurgist.

The Reviewing Stand

A READER suggestion that tied right in with the plan outlined in this department last month concerned another feature of *Metals Review*—namely, manufacturers' descriptions of new products. Why (it occurred to us), if an annual survey of developments in a specific field as reflected in the technical literature is a good thing, should not a similar annual review of new and improved equipment in that field be a natural accompaniment? What's more, it would answer many readers' pleas for more accurate and informative product descriptions.

Great pains are taken to make these reviews as complete as possible. First, a direct mail circulation of the leading manufacturers in the field to be covered, asking for brief descriptions of any products that are new or improved during the past 12 months. Then an exhaustive combing of the "new product" sections of appropriate magazines to pick up any items not received by direct solicitation. Finally, sorting and classifying and correlating the various items to produce a continuous, integrated story with superfluous verbiage removed and only the meat of the descriptions remaining.

Thus was born the monthly special feature section of *Metals Review*—an informative supplement and complement to the Review of Current Metal Literature. The first article in the feature section reviews the year's technical literature and details the most important developments; the second describes new equipment and processes devised by the manufacturers. The first is a library index as well as an informative article; the second constitutes virtually a "where-to-buy" guide. Each month a different subdivision of metallurgy is treated; at the end of the year the entire field has been studied and analyzed.

Ex Index?

Faithful fans and readers will doubtless have observed that the "Materials Index" has been omitted from recent issues of the Review of Current Metal Literature. This was necessitated by the rapid increase in number of publications (chiefly foreign) being annotated, which has taxed available space and labor to the utmost.

However, we do not want to sacrifice reader convenience and usefulness to expediency. If you think the Materials Index should be continued, let us know. Some of you may even have ideas about a whole new classification system—a matter perhaps worthy of serious consideration. Any and all comments will be welcomed—whether one sentence or several pages.

M.R.H.

the use of electric current, known as electroless plating, and brought about by chemical reduction of a nickel or cobalt salt with hypophosphite in hot solution. The process was developed by Abner Brenner and Grace E. Riddell of the U. S. National Bureau of Standards. The reaction is catalytic, and under the prescribed conditions of concentration and pH, no plating occurs unless certain metals, such as steel or nickel, are introduced in the bath.

8-132. Automatic Electroplating Line. A. H. Allen. *Steel*, v. 121, Aug. 25, 1947, p. 80-83, 126, 128.

One of the largest and most completely automatic copper-nickel-chromium electroplating installations in the world is now in operation at the plant of Pontiac Motor Division.

8-133. Blistering of Cadmium Plate on Soldered Steel. E. R. Bowerman. *Monthly Review*, v. 34, Sept. 1947, p. 1026-1032.

Blistering of electrodeposited coatings has generally been attributed to faulty plating techniques, but type of blistering described is due to alloy formation between the electrodeposited metal and the base metal.

8-134. Anodes—II. Cast, Rolled, Electrodeposited and Extruded Copper. E. R. Thews. *Metal Industry*, v. 71, Aug. 15, 1947, p. 126-128.

Production, choice, and uses.

8-135. Introduction to the Electrochemistry of Protective Films. G. V. Akimov. *Progress in Chemistry (U.S.S.R.)*, v. 16, May-June 1947, p. 353-363. (In Russian.)

Electrodeposited metallic films on metal. 12 ref.

8-136. Electroplated Tin Coatings. *Canadian Metals & Metallurgical Industries*, v. 10, Aug. 1947, p. 20.

A process known as Speculum plating developed by the British Tin Research Institute.

8-137. Plating Practice at Ternstedt. *Die Castings*, v. 5, Sept. 1947, p. 58, 60, 62-64.

Buffing, cleaning, plating, and stripping of zinc-base die castings.

8-138. Practical Applications of Modern Products. *Products Finishing*, v. 11, Sept. 1947, p. 88, 90, 92, 94, 96.

Automobile hardware plating plant produces 1½ acres of plating every 8-hr. shift. Electropolishing process for stainless steel at American Rolling Mill Co. Washing machine manufacturer gains precision with power brushing.

8-139. Electroplating; Modern Uses in the Engineering Industry. W. F. Coxon. *Metal Industry*, v. 71, Aug. 29, 1947, p. 170-172.

Electroforming applications; use of porous chromium on piston rings; plating control; machinable hard chromium; journal repair; electroplated bearings.

8-140. Practical Copper Reduction on Nonconductors. Harold Narcus. *Metal Finishing*, v. 45, Sept. 1947, p. 64-67, 70.

New method to be used prior to application of metallic coatings. Reduction takes place by treatment with Fehling's solution and a metallo-organic derivative of sodium hydrosulphite. The commercial adaptability of this process for plating on plastics; advantages over the usual silver nitrate method. 12 ref.

8-141. High Production Job-Shop Plating. Louis J. Donroe. *Metal Finishing*, v. 45. Sept. 1947, p. 71-74.

Surface preparation procedures on full automatic and semi-automatic plating equipment in one of the largest job-shop plating plants in the country.

8-142. Rectifiers for Electroplating—Part IV. Louis W. Reinken. *Metal Finishing*, v. 45. Sept. 1947, p. 75-78.

Circuits for on-off control; protection; meters.

8-143. Toxicity of Chemicals in Electroplating. (Continued.) P. M. Van Arsdell. *Metal Finishing*, v. 45, Sept. 1947, p. 79-83.

Chromates; cobalt compounds; copper and copper salts; gold compounds; iron and the ferric salts; lead and lead salts; mercuric salts; nickel and nickel salts; rhodium; platinum; palladium. (To be continued.)

8-144. The Control and Maintenance of Electroplating Solutions. Part IV. (Concluded.) P. Berger. *Sheet Metal Industries*, v. 24, Sept. 1947, p. 1820-1824.

Cadmium and zinc solutions of the cyanide type, and tin solutions.

8-145. A Comparison of British and Spanish Practice in the Chromium Facing of Press Dies. Juan B. Vericat Raga and Joaquín Agulló Marly. *Sheet Metal Industries*, v. 24, Sept. 1947, p. 1829-1833; discussion, p. 1833-1835, 1839.

Two Spanish technicians make a critical analysis of "Chromium Facing Press Dies", by E. A. Ollard and E. B. Smith, which appeared in the June issue. Authors' reply. (Reprinted from *Técnica Metalúrgica.*)

For additional annotations indexed in other sections, see: 11-142.

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9 PHYSICAL TESTING

9-110. Measuring Creep. G. R. Gohn. *Bell Laboratories Record*, v. 25, Aug. 1947, p. 311-313.

Creep measurement on sections of cable sheath.

9-111. Preparation of Test Specimens. G. L. Smith. *Sheet Metal Industries*, v. 24, Aug. 1947, p. 1609-1614.

Methods of preparing test specimens used in a research laboratory engaged in the production of steel and steel tubes. The preparation of sulphur print specimens, macros, and micros, and the general methods of preparation of the commoner test pieces (tensile, impact, creep).

9-112. Cast and Extruded Magnesium Alloys. D. E. Dineen and N. D. Benson. *Metal Industry*, v. 71, Aug. 8, 1947, p. 103-105.

Some mechanical tests at room and low temperatures.

9-113. Method for Predicting Failure of Metals. P. E. Cavanagh. *Petroleum Engineer*, v. 18, Aug. 1947, p. 120, 122, 124; discussion, p. 127-128.

Possibilities of using changes in high-frequency magnetic and eddy-current losses to predict failure in metals. Method of recording and examples of stress-core loss curves obtained.

9-114. Influence of Plastic Extension and Compression on the Fracture Stress of Metals. D. J. McAdam, Jr., G. W. Geil and W. H. Jenkins. *American Society for Testing Materials Preprint 30*, 1947, 19 p.

Results of longitudinal and transverse tests on cold-extended steel plate and of tension tests on previously compressed cylindrical steel bars. The general effect of plastic deformation on the fracture stress is a work-hardening effect similar to the effect on the flow stress. Conclusion is that any kind of plastic deformation of any polycrystalline metal affects the fracture stress in the same way that it affects the corresponding flow stress.

9-115. Determination of Stress-Rupture Parameters for Four Heat Resisting Alloys. William G. Lidman. *National Advisory Committee for Aeronautics, Research Memorandum No. E7G 18a*, Aug. 25, 1947, 16 p.

Stress-rupture data for four heat resisting alloys analyzed according to the equations of the theory of rate processes. Parameters of structure and composition for forged S816, cast S816, cast S590, and cast Vitallium and method of obtaining these parameters.

9-116. Variation of the Damping Decrement of Turbine Blades in Service. L. A. Glikman and M. I. Grinberg. *Engineers' Digest (American Edition)*, v. 4, Aug. 1947, p. 364-366.

Failures of turbine blades of the ninth stage in a powerful steam turbine, which were obviously due to fatigue, led to investigations into the vibrations of these blades. The object was to determine the natural frequency of the blade groups, or "packets", and to ascertain the possibilities of tuning the blades. (Translated and condensed from *Journal of Technical Physics*, v. 16, no. 9, 1946, p. 985-992.)

9-117. Mechanical Tests of Aluminum and Aluminum Alloys. *Aluminium and the Non-Ferrous Review*, v. 12, April-June 1947, p. 43-45.

Condensed from publication of Northern Aluminium Co., Ltd. (To be continued.)

9-118. Proving Rings. *Engineering*, v. 164, Aug. 22, 1947, p. 169-172.

Devices for calibrating testing machines at the National Bureau of Standards. (See NBS Circular C454, 1946.)

9-119. Creep Tests; Their Conduct and Evaluation. W. Siegfried. *Iron and Steel*, v. 20, Aug. 1947, p. 396-397; discussion, p. 405-407.

Sustained-load tests carried out on various highly heat resistant alloys used in the construction of gas turbines. Results are evaluated in terms of the main problems in gas turbine design.

9-120. New Hardness Tester. T. Dobry. *Industrial Diamond Review*, v. 7, Aug. 1947, p. 244-245.

In the instrument described the impression is made mechanically, and measurements are made optically, so that one can either magnify the image of the impression or project it onto a screen. (Translated and abstracted from *Hutnicke Listy*, v. 1, 1946, p. 177-180.)

9-121. New Apparatus for Axial-Load Fatigue Testing. William N. Findley. *ASTM Bulletin*, Aug. 1947, p. 54-56.

Fatigue testing machine permits testing of specimens in axial tension or compression. The machine is designed with provision for detecting and correcting strains introduced into the specimen when it is fastened to the machine. Thus the stress may be made more nearly uniform over the cross section of the specimen than is usually possible.

9-122. Discussion of Paper on Reproducibility of the Single-Blow Charpy Notched Bar Test. L. D. Jaffe. *ASTM Bulletin*, Aug. 1947, p. 88-89.

Comparison of V-notch and keyhole specimens. Authors' reply by N. A. Kahn and E. A. Imbembo.

For additional annotations indexed in other sections, see: 3-267-269-285; 19-298; 22-532; 24-273-277-278; 27-190-198.

(Turn to page 24)

Oak Ridge Chapter Is Installed and Welcomed by Focke

Reported by Fred W. Droster

Interim Secretary-Treasurer

Thursday evening, Oct. 2, a page was written in Oak Ridge metallurgical history. At a dinner at Grove Hall in Oak Ridge, 49 members met with three guests from our sister city of Chattanooga and Trustee Arthur E. Focke, of Diamond Chain and Mfg. Co. of Indianapolis, to take part in the installation of an ASM chapter in this, the "Atom City".

The group of metallurgists and engineers, who had met a few short months before to inaugurate necessary procedure toward recognition as an active chapter in the national organization, having fulfilled both the requirements of the national organization and those of the authorities at Oak Ridge, saw their ambitions realized. The membership was well pleased with the words of welcome of Dr. Focke. He further demonstrated the value of the organization with his presentation of the topic "Mechanical Testing". The talk, well illustrated with slides, showed metallurgy in action, in the operation of a quality control unit in one of the country's essential metallurgical product manufacturers.

Interim Chairman Robert W. Coyle, metallurgist at Fairchild's Oak Ridge plant, formerly of Tennessee Eastman Magnetic Separation Plant, presided at the festivities. Each member introduced the neighbor at his side and gave his company affiliation—a simple matter at Oak Ridge, since members are employed either at the Clinton National Laboratories (formerly Monsanto, Clinton Labs); Carbide and Carbon's two plants, K-25 and Y-12; or the Fairchild N.E.P.A. Plant, or are employees of the Atomic Energy Commission. With but one exception, all live in Oak Ridge.

A committee has been chosen to present a slate of officers, to serve until April next. The committee consists of:

Clifton B. Graham, of the Carbide and Carbon Y-12 Plant, formerly of the Eastman Co.

Charles Green, of the Carbide and Carbon K-25 Plant.

Raymond E. Tate, of Fairchild's N.E.P.A. Plant.

Edward J. Boyle, of the Clinton Laboratories.

Induction Groups Formed

A new electrical product group comprising 11 companies nationally recognized in the industry that manufactures apparatus for induction and dielectric heating is announced by the National Electrical Manufacturers' Association.

Chairman of the group, known as the Induction and Dielectric Heating Apparatus Section, is H. B. Osborn, Jr., ASM sales manager, Tocco division, the Ohio Crankshaft Co., Cleveland. C. W. Miller, sales manager, industrial electronics division, Westinghouse Electric Corp., Baltimore, Md., is vice-chairman.

Transferred to Pittsburgh

Robert B. Wallace, formerly metallurgist for Carnegie-Illinois Steel Corp., Youngstown District, has been transferred to the alloy unit, metallurgical division, in the office in Pittsburgh. Mr. Wallace was secretary-treasurer of the Mahoning Valley Chapter ASM, and as publicity chairman for the past two years, has served as reporter to *Metals Review* of his chapter's activities.

Tool Wear Studies Related

Reported by G. F. Kappelt

Assistant Metallurgist, Bell Aircraft Corp.

"Specific Studies Pertaining to Tool Wear, Chip Characteristics, and Surface Finish of Free-Cutting Steels" were detailed by G. P. Witteman, assistant metallurgical engineer of the Bethlehem Steel Co., before the Buffalo Chapter ASM in September. His remarks were a summary of a paper by that title which Mr. Witteman presented before the American Society of Mechanical Engineers last June and which is published in the August 1947 issue of that society's *Transactions*.

Hardenability Buying of Alloys Made Easy by Ryerson Tests*

Specification of alloys on the basis of hardenability, as well as chemical analysis, provides double assurance that your steel will meet job requirements. Ryerson enables you to order this way by testing every heat of annealed and as-rolled alloy in stock.

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RYERSON STEEL

10 ANALYSIS

10-150. Deux Réactions d'Identité, Très Sensibles, de l'Aluminium et de l'Etain Métalliques. (Two Very Sensitive Identification Reactions of Metallic Aluminum and Tin.) Georges Deniges. *Comptes Rendus*, v. 224, June 30, 1947, p. 1799-1801.

Certain mercury salts are used to determine minute quantities of aluminum and tin. Accurate determinations have been made with as little as 0.2 mg. of metal.

10-151. Direct Colorimetric Method for Phosphorus in All Types of Steel. Henry L. Katz and Kenneth L. Proctor. *Analytical Chemistry*, v. 19, Aug. 19, 1947, p. 612-614.

How Hague and Bright's method for the colorimetric determination of phosphorus in steel and cast iron has been modified to eliminate interferences incurred with high-chromium, columbium, and tungsten steels.

10-152. Contribution to the Study of an Inorganic Semiquantitative Method of Analysis: Analysis of Chromium and Nickel. Paul E. Wenger, D. Monnier and Y. Rusconi. *Analytica Chimica Acta*, v. 1, June 1947, p. 190-200. (In English.)

Dilution of a known solution of the desired element determines the limit of sensitivity of the reagents. By calculation from the values obtained, tables can be established which give directly the percentage of the limit being determined. Procedure as applied to the determination of chromium, nickel, bismuth, molybdenum and manganese.

10-153. Sur Une Stilliréaction du Cobalt. (A Spot Reaction for Cobalt.) Clément Duval. *Analytica Chimica Acta*, v. 1, June 1947, p. 201-204.

A microchemical test for cobalt. The spot test is satisfactory even in the presence of nickel, and is applicable in the presence of other ions of the cobalt group.

10-154. Note Sur la Stilliréaction du Cobalt Sous Forme d'Hexanitritocobaltate (III) de Potassium. (Note Concerning a Spot Reaction for Cobalt in the Form of the Hexanitritocobaltate (III) of Potassium. Clément Duval and Colette Soye. *Analytica Chimica Acta*, v. 1, June 1947, p. 205-206.

Conditions for micro-analytical detection of cobalt. Absolute sensitivity is 0.04μg. Nickel does not interfere.

10-155. Analytical Methods of Investigating Some Highly Refractory Carbides and Nitrides. (SiC, B_4C, BN) (Project No. KQ-253). Hans Bielstein. *Headquarters Air Materiel Command Technical Report No. F-TR-1154-ND GS-AAF-Wright Field No. 34*, Aug. 1947, 14 p.

Special methods for the exact quantitative analysis of silicon carbide, boron carbide, boron nitride, and their common impurities used in the analytical laboratory of the Electro-Schmelzwerk, Kempten-Allgaeu.

10-156. Application of a Geiger-Muller Counter to Chemical Analysis at Low Concentrations of Elements in Different Materials. N. D. Borisov and Ia. M. Fogel. *Journal of Technical Physics (U.S.S.R.)*, v. 17, no. 5, 1947, p. 599-612. (In Russian.)

The intensity of monochromatic X-ray radiation and the number of pulses of a Geiger counter are directly proportional to each other. This fact led to the development of a method for qualitative and quantitative determination of small concentrations of elements. It is useful for nondestructive analysis of beryllium foil and bronze ribbon, and for the presence and amount of iron, zinc, copper, and silver impurities. 12 ref.

10-157. The Spectrographic Analysis of Ferrosilicon. J. H. Coulliette. *Journal of the Optical Society of America*, v. 37, Aug. 1947, p. 609-613.

A method for the spectrographic analysis of materials consisting of two or more components. Application to the analysis of ferrosilicon. Eliminates necessity for adding a standardizing material to the sample or making approximations to correct for reference element dilution.

10-158. Direct-Reading Device Provides Rapid Steel Analysis. E. R. Vance. *Steel*, v. 121, Sept. 22, 1947, p. 92, 94.

Spectrometer instrumentation which produces a quantitative analysis report for eight elements within 40 sec. after the sample is placed in the electrode holders. Results are reported to the melt shop in 5 to 6 min. after the test is taken.

10-159. Polarographic Determination of Zinc in Aluminum Alloys. (Concluded.) W. Stross. *Metallurgia*, v. 36, Aug. 1947, p. 223-225.

Three methods for determining zinc.

10-160. Report on Cadmium. A. K. Klein. *Journal of the Association of Official Agricultural Chemists*, v. 30, Aug. 1947, p. 455-456.

Additional results obtained using method previously described for Cd in the range 0 to 25 mmg. (Volume 28, 1945, p. 257.)

For additional annotations indexed in other sections, see:
7-357; **27**-188.

157 brief digests covering all published developments in this field during 1946 appear in Vol. 3, ASM Review of Metal Literature. Vols. 1, 2 and 3 together give you three-year index to the metal industry. Each Vol. $10.00 to ASM Members. $15.00 to Nonmembers. American Society for Metals, 7301 Euclid Ave., Cleveland 3.

11 INSTRUMENTS
Laboratory Apparatus

11-135. Stereoscopic Drawings of Crystal Structures. W. L. Bond. *American Mineralogist*, v. 32, July-Aug. 1947, p. 454-461.

A method for getting stereoscopic pairs of atomic structure views given the coordinates of the atoms and cell constants.

11-136. Ultrasonic Measurements on Single Crystals. H. B. Huntington. *Physical Review*, v. 72, Aug. 15, 1947, p. 321-331.

An ultrasonic pulse technique has been applied to measure the mechanical properties of some single crystals at 10 mc. per sec. Attenuation in alkali-halide single crystals is small. Internal friction in the copper single crystal is high in comparison with that found at lower frequencies, even for unannealed specimens. Attenuation in Rochelle salt is also quite high. 24 ref.

11-137. Microscopical Examination as a Guide to Quality in Engineering Tin Bronzes. W. T. Pell-Walpole. *Metal Treatment*, v. 14, Summer 1947, p. 69-83.

Microscopic studies of the effects of heat treatment, working, segregation, and porosity on the microstructures of bronzes of various compositions.

11-138. High-Temperature Furnace for Electron Diffraction Studies. Earl A. Gulbransen. *Review of Scientific Instruments*, v. 18, Aug. 1947, p. 546-550.

A furnace for use with the electron diffraction camera for the study of chemical and physical reactions occurring on surfaces up to 1000° C.

11-139. A High-Temperature X-Ray Diffraction Apparatus. L. S. Birks and H. Friedman. *Review of Scientific Instruments*, v. 18, Aug. 1947, p. 576-580.

An apparatus for heating an X-ray specimen to 1200° C. in vacuum while its diffraction pattern is being recorded continuously on a Geiger-counter spectrometer. The heater consists of a length of 0.030-in. tungsten wire embedded in beryllium oxide, the whole enclosed in a polished tantalum case. Either a flat metal sheet or powder packed in platinum gauze mounted on sheet metal is suitable as a specimen. Rapid structure changes may be observed as they occur with this apparatus.

11-140. Electrolytic Polishing. *Journal of the Iron and Steel Institute*, v. 156, Aug. 1947, p. 524-526.

A simplified anode connection discussion by James Pow of paper by H. J. Merchant (Feb. issue). Author's comments.

11-141. Electronic Comparators. *Automobile Engineer*, v. 37, Aug. 1947, p. 310-312.

Stress effects, dimensional comparisons, and special applications.

11-142. Electroplating Control Laboratory. H. J. Sedusky and J. B. Mohler. *Metal Finishing*, v. 45, Sept. 1947, p. 60-63.

Necessary equipment and procedures. (To be continued.)

11-143. Methods Used in the Preparation of Test Specimens. G. L. Smith., *Sheet Metal Industries*, v. 24, Aug. 1947, p. 1609-1614; Sept. 1947, p. 1809-1814, 1824.

The identification marking of specimens; methods for preparing metallographic specimens; preparation of samples for analysis. (To be concluded.)

For additional annotations indexed in other sections, see:
13-39; **27**-182-183-211.

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116 brief digests covering all published developments in this field during 1946 appear in Vol. 3, ASM Review of Metal Literature. Vols. 1, 2 and 3 together give you three-year index to the metal industry. Each Vol. $10.00 to ASM Members. $15.00 to Nonmembers. American Society for Metals, 7301 Euclid Ave., Cleveland 3.

12 INSPECTION AND STANDARDIZATION

12-163. Statistical Methods Applied to the Inspection of Porcelain Enamel. L. S. Kauffman. *Ceramic Industry*, v. 49, Aug. 1947, p. 61-62.

Experiences of the American Stove Co. (Reprinted from *Industrial Quality Control*, Nov. 1946.)

(Turn to page 26)

Many Variables Cited in B-36 Design Problems

Reported by Richard L. Priess
Southern Power & Industry

Aeronautical design and process engineers are continually confronted by new, comprehensive, and almost infinite combinations of materials and methods specifications in the production of today's military and commercial aircraft. The many variables and the enormous latitude in designing and producing the B-36 were discussed at the initial fall dinner meeting of the North Texas Chapter, held jointly with the North Texas Chapter A.S.T.E.

Nearly 100 metallurgical and tool engineers heard H. W. Hinkley, chief project engineer, and J. W. Larson, assistant division chief engineer of Consolidated-Vultee (designers and builders of the B-36), discuss the design procedures, specifications, and performance data of the well-publicized bomber, now in production at Consolidated's Fort Worth plant.

Technical boundaries in the aeronautical science of engineering, according to the engineers, simply do not exist. There is no handbook, and metallurgical and process engineers are continually confronted by new materials and improved methods. Choice of materials involves both engineering and economic considerations—strength-weight ratio, corrosion, temperature, velocity, shock and fatigue strength, availability, cost and standardization of processing operations, to mention only a few.

More care in materials selection was predicted in the future by the Consolidated design engineers, particularly in the production of long-range military aircraft. Selection will be largely based on modern methods of testing structural aircraft assemblies to determine operating stresses for various designs. Many of these methods were summarized in "Design Progress in 1946" published in the August issue of *Metals Review*. Computing machines, supplementing conventional slide rules, will offer laboratory flexibility in the rapid determination of fatigue effects, flutter analysis, shear and bending stresses, it was predicted.

The two technical discussions were supported by a technicolor picture of the B-36 flights.

Opens New England Practice

Greswold Van Dyke, a metallurgical consultant for the past 29 years and until recently associated with Joseph T. Ryerson & Son, Inc., in Chicago, has moved to East Dennis, Mass., and is acting as consultant for several New England organizations that are users of steel. He has transferred his membership from the Chicago to the Boston Chapter.

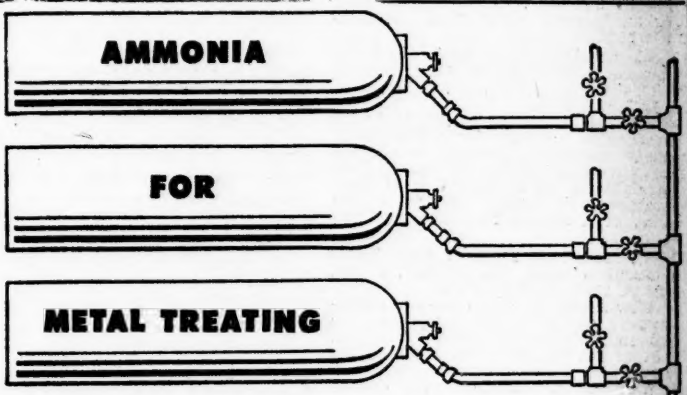
Prizes for Technical Papers

To promote the publication of more and better technical articles in the trade press describing the economic advantages obtained by the use of modern industrial furnaces, kilns and ovens, the Industrial Furnace Manufacturers Association, Inc., is sponsoring a contest with prizes amounting to $1500. Authors of articles published in the trade press between Oct. 1, 1947, and Sept. 30, 1948, are eligible for the awards, which will consist of three prizes of $1000, $300, and $200. Formal rules and further details can be secured from the Industrial Furnace Manufacturers Association, Inc., 420 Lexington Ave., New York 17, N. Y.

New Film Demonstrates Use of High-Speed Camera

A new 16-mm. silent film illustrating the use of high-speed motion picture to study swift, blurred, or transient action is available from the Eastman Kodak Co., 343 State St., Rochester 4, N. Y.

Entitled "Time Magnification," the motion picture includes sequences in both black-and-white and color taken with the Eastman high-speed camera, Type III, at speeds ranging from 1000 to 3000 frames per second. The film shows, among other subjects, a riveting machine, high-speed cutting tools in operation, and an electric welding arc.



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12-164. Effect of Taper Tolerance on Taper Gage Measurements. W. Richards. *Machinery (London)*, v. 71, Aug. 7, 1947, p. 150-153.

Illustrated by diagrams.

12-165. Application of Supersonics in Industrial Inspection. James W. Dice. *Engineers' Digest (American Edition)*, v. 8, Aug. 1947, p. 352, 396.

Two basic testing techniques are in use in industry today. The first, or "through transmission" method, employs two transducers, one to send the supersonic vibration into the test piece and the other to receive the transmitted vibration as it emerges from the other side of the piece. The second basic testing technique, the "reflection" method, is known as a Reflectoscope. It sends supersonic vibrations through the material under test and measures the length of time it takes these vibrations to penetrate the material, reflect from the opposite side, or an internal defect, and return to the sending point.

12-166. Testing of Flatness by the Beam Comparator Method. R. Marriner and W. O. Jennings. *Engineer*, v. 184, Aug. 22, 1947, p. 164-165.

Method for testing quickly and with reasonable accuracy large batches of surface plates of the same size uses a sensitive dial indicator to compare the straightness of a succession of generators in the surface under test with that of a known reference straightedge.

12-167. Magnetic Tests of Spot Welds in Stainless Steel. *Engineering*, v. 164, Aug. 22, 1947, p. 177-178, 180.

New inspection technique and equipment. A plastic cell, containing an oil in which magnetic particles are suspended, placed in contact with the spot weld. The particle distribution pattern formed indicates the quality of the weld.

12-168. Transitional Evaluations and Treatment of Experimental Data Subject to Very Wide Scatter. Wendell P. Roop *ASTM Bulletin*, Aug. 1947, p. 73-76.

Data on the effects of temperature on the ductility of steel illustrate effects of scatter and treatment of numerical results. Methods of analysis and planning of experiments.

12-169. Internal Pressure Chart for Round Stainless Steel Tubing. Benjamin Ostlind. *Product Engineering*, v. 18, Sept. 1947, p. 177.

Diagram shows safe working pressures for small hydraulic stainless steel tubing with outside diameters from ⅛ to 1 in., wall thicknesses from 0.009 to 0.065 in., ultimate tensile strengths from 30,000 to 120,000 psi. and safety factors from 2 to 6. It also shows the weight of stainless steel tubing in pounds per lineal foot.

12-170. Production Thread Gaging. D. E. Mick. *Tool & Die Journal*, v. 13, Sept. 1947, p. 83-84.

Gaging fixture for the rapid inspection of large-pitch-diameter threads by unskilled operators. Variations in the pitch diameter cause an increase or decrease in the amount of air flowing from an orifice. This variation in air flow is measured on a gage which magnifies a tolerance of a few thousandths into a visual reading ranging over several inches.

12-171. The Inspection and Testing of Brazed Joints With Especial Reference to Silver Alloy Brazing. J. L. Christie and A. M. Setapen. *Welding Journal*, v. 26, Sept. 1947, p. 767-770.

Several kinds of tests which are frequently used as part of inspection programs, although specific, quantitative tests are not proposed.

For additional annotations indexed in other sections, see:
3-290; **4**-116; **22**-478; **27**-170-201-206.

13 PYROMETRY
Temperature Control

13-39. Electronic Temperature Recorders. George M. Chute. *Instrumentation*, v. 2, July-Aug. 1947, p. 11-13.

Circuits and operation.

13-40. Automatic Control in Commercial Heat Treating Plant. C. C. Roberts. *Instrumentation*, v. 2, July-Aug. 1947, p. 23-24.

Controls for draw furnace, isothermal quenching furnace, hardening furnace, high-temperature furnace, preheat and hardening furnace, liquid carburizing furnace.

13-41. New Thermocouple Increases Aluminum Casting Production. *Instrumentation*, v. 2, July-Aug. 1947, p. 25-26.

New portable thermocouple assembly for molten aluminum.

13-42. Instruments—Key Production Tools at Bethlehem Steel. Frederick R. Pullen. *Instrumentation*, v. 2, July-Aug. 1947, p. 27-30.

Maintenance of tools and duties of various maintenance officers.

13-43. Temperaturmätning i Stalbad. (Temperature Measurement in Steel Baths.) Sven Fornander. *Jernkontorets Annaler*, v. 131, no. 7, 1947, p. 225-242.

The quick-immersion method for temperature measurements in liquid steel. A pyrometer of British design gave good reproducibility and accuracy. 80 measurements could be made with one hot junction without any measurable change in e.m.f. 17 ref.

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14 FOUNDRY PRACTICE

14-236. Making Dies for Casting Gray Iron. H. K. Barton. *Machinery (London)* v. 71, July 31, 1947, p. 131-134.

Essentials of the Holley process for die casting gray iron are: a rotatable frame upon which a number of die carriages are mounted, and a source of molten metal which allows tapping at shorter intervals than is normal in iron-founding practice. Sand casting of dies; standardizing a limited number of die sizes.

14-237. Some Notes on Feeding. S. L. Finch. *Foundry Trade Journal*, v. 82, July 31, 1947, p. 297-303.

Crystallization, solidification and subsequent shrinkage. The growth of metallic crystals, latent heat of fusion, specific heat and gas content as related to the mechanism of freezing.

14-238. Abrasive Blasting of Castings. R. L. Orth. *American Foundryman*, v. 12, Aug. 1947, p. 22-25.

Castings are blasted to remove the mold elements that stick to the internal and external surfaces, as well as the scale formed by oxidation when the molten metal comes in contact with the mold or through subsequent annealing and heat treating operations. Advantages, and selection and operation of equipment.

14-239. Preventing Shrinkage in Gray Iron Castings; Tellurium Corewashers as Chill Inducers. W. P. Sullivan. *American Foundryman*, v. 12, Aug. 1947, p. 26-28.

Application and beneficial effects of a tellurium-base corewash in avoiding shrinkage in the gray iron foundry.

14-240. Precision Casting Small Aluminum Impellers. Eugene M. Cramer. *American Foundryman*, v. 12, Aug. 1947, p. 36-38.

Production of limited numbers of sample parts presented problems requiring a plaster mold, with adaptations of semicentrifugal and static casting techniques. Two types of impellers were produced, one type permitting parting along edges of the blades and diagonally across the rim; the other having overlapping blades.

14-241. Engineering and Design of Aluminum Permanent Molds. E. G. Fahlman, E. V. Blackmun, W. J. Brinkman, H. R. Doswell, W. J. Klayer, G. C. Kohls, C. H. Morrison and E. C. Nocar. *Modern Metals*, v. 3, Aug. 1947, p. 24-25.

A permanent mold casting is one which is made in a heated metal mold with or without the use of sand or metal cores and poured by gravity only, and is gated and fed very much the same as a sand casting, but within the limitation of the process. When a sand core is used the casting is known as a semipermanent mold casting.

14-242. Die Casting Aircraft Parts. H. L. Harvill. *Modern Industrial "Press"*, v. 9, Aug. 1947, p. 44, 46, 48.

Presses designed for cold-chamber die casting (whereby a molten alloy is ladled from a melting pot into an injection cylinder on the die-casting machine, so that it can be forced into a closed die by means of a piston acting in a cylinder) and hot chamber die casting (during which the injection cylinder of the machine is either wholly or partly immersed in a molten alloy).

14-243. The Foundry Atmosphere. William N. Witheridge. *Iron Age*, v. 160, Aug. 21, 1947, p. 62-67.

Means of improving atmosphere conditions; common misconceptions concerning ventilating techniques; dust control equipment.

14-244. Principles of Precision Investment Casting. Part III. Kenneth Geist and Robert M. Kerr, Jr. *Foundry Trade Journal*, v. 82, July 31, 1947, p. 291-296.

Air pressure makes the casting, because when the vacuum is created in this instance, the atmospheric pressure forces the metal into place.

14-245. Pressure Die Casting Magnesium. J. L. Erickson. *Light Metals*, v. 10, Aug. 1947, p. 390-395.

Development and practice of pressure casting for the ultralight alloys, and fundamental theory in comparison with the process as applied to aluminum.

14-246. Present and Future Heating Applications in Precision Casting. Paul L. Butler. *Industrial Gas*, v. 26, Aug. 1947, p. 20, 26, 28.

Fabrication of a master pattern, use of the pattern in making a mold, injection of wax into the mold to produce a wax pattern. The control and kind of heat in all steps of the process are perhaps the most important factors in the successful manufacture of precision castings.

14-247. The Foundry Atmosphere. Part II. William N. Witheridge. *Iron Age*, v. 160, Aug. 28, 1947, p. 67-73.

Practical suggestions for improving the atmosphere of foundries, large and small. Engineering problems, measurement of air contamination, salvage of existing equipment, air sources, out-

(Turn to page 28)

Address to Entering Freshmen on

The Nature of Engineering Education

By Robert F. Mehl

Director, Metals Research Laboratory, Carnegie Institute of Technology
Chairman, Advisory Committee on Metallurgical Education

It is my duty to tell you what it is to study to become an engineer. I shall try to help you to look at a few important aspects of your task, attempting to set your point of view on the four years' work that lies before you.

A faculty in devising educational programs must steadily keep in mind the student's final goal—to be a successful practicing engineer. An engineer is primarily one who *does*, not one who only *knows*. The teacher must decide on what *abilities-to-do* the graduate must possess when he is practicing as an engineer, for it is upon these that an engineering career rests. These are known to your faculty; on the basis of these, curricula are planned, courses developed, and details laboriously devised. It would please you, I think, to know what extraordinary and even unique efforts have been made at this institution in conceiving and developing in detail ways and means that will work to your advantage. Whatever you may experience in your courses here, you may be sure that it is there for a purpose, carefully measured and weighed, to the end that it will contribute to your future.

Before the rapid development of science and engineering that has characterized the present century, it was far easier to study to become an engineer than it is now, for there was little to learn, and native intelligence was often enough. Now, with the fearful mass of principles, of industrial techniques and processes, what must engineering education be?

Engineering training is intended to supply you primarily with a hard core of essential basic knowledge, with tools of thought, with methods of approach to engineering problems, and with exercises, chiefly through problem solving, that will develop powers, not only to know and to learn, but to *do*, for in the end an engineer is one who acts; he builds a furnace, designs a process, develops a method, creates a machine, erects a dam, runs a factory. This is the training you will experience, so that when you graduate you may be like the interne in medicine—thoroughly well-trained fundamentally, ready to learn further in practice.

Whatever it is you learn, in school or later—a bit of subject matter, a method of analysis, a way of going about a typical engineering task—learn it well, with utmost clarity, and with the most complete understanding; otherwise all your increasing learning will be, as Spencer said, only increasing confusion. Learn a few deeply basic things well; no one in this year can be encyclopedic and still useful.

In the immense complexity of modern industry the engineer finds his work. We can itemize the essential feats he performs: He must be able to recognize an engineering problem. He must be able to identify and apply the pertinent principles of science. He must devise practicable engineering solutions, employing to the full all of the principles of engineering he knows and will continue to learn. He must use the ingenuity in the art of engineering with which nature has endowed him, and education and experience have matured. And he must then subject whatever solution has occurred to him to the economic analysis that will determine whether society can afford it. And finally he must consider whether society, as an aggregate of humans, will accept it. This composite of tasks constitutes engineering.

So much for engineering itself. I must not stop here, else I should not be talking about the whole of your course. A foundation of basic science I commend to you. Regard it seriously. It is not a theater ticket for admission to advanced courses. The proper knowledge of the content, and primarily the capacity to make use of basic science will be a requirement in your lives, not only here, but long, long after, in the practice of your profession. Engineering courses and engineering itself are built upon basic science.

If an engineer worked in a vacuum, he could forget all but his science and his engineering. We work in a human world, in a society. An engineering accomplishment is not accomplishment at all, if it is uneconomic—that is, if society finds it not in accord with its needs; nor is it an accomplishment if it is harmful to the common good. An engineer can build a bridge, or a battleship, only because it fills a need of society. The research man in the ivory

(Turn to page 29)

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14-248. Some Notes on the Surface Drying of Molds. A. Cracknell and F. Cousans. *Foundry Trade Journal*, v. 82, Aug. 7, 1947, p. 313-315; Aug. 14, 1947, p. 343-347; Aug. 21, 1947, p. 365-369.

The effect of varying the volume and temperature of the air passing over the surface of a mold, when rammed with sand, has been studied and an attempt made to correlate these factors with the time taken to dry out the surface layers. The effect of variation in grain size and permeability of sands; some results of air, skin, and torch drying. (Presented at Nottingham Conference of Institute of British Foundrymen.)

14-249. Discussion on Control of Bronze Melts for the Production of Pressure-Tight Castings. *Foundry Trade Journal*, v. 82, Aug. 7, 1947, p. 317-318, 324.

Discussion of paper by W. A. Baker in July 10th issue. Temperature gradient; oxidation of melts; degassing treatments; mold reaction.

14-250. Some Notes on Feeding. S. L. Finch. *Foundry Trade Journal*, v. 82, Aug. 7, 1947, p. 319-324. (Concluded.)

The flow of metal from feeder head to casting; suggestions for improvements in methods. (Presented at Nottingham Conference of Institute of British Foundrymen.)

14-251. Die Casting for Aluminum Engines. Gilbert Close. *Light Metal Age*, v. 5, Aug. 1947, p. 6-7.

The use of aluminum die casting has resulted in three advantages; namely, very few machine operations are required, rejected parts are held to a minimum, redesign of motors in production, or institution of new motor types, requires a minimum of retooling with major costs confined to replacement of die-caster dies.

14-252. Present and Future Heating Applications in Precision Casting. Paul L. Butler. *Industrial Heating*, v. 14, Aug. 1947, p. 1290, 1292, 1294.

The various heat operations and suggested improvements in the production of precision castings, from the preparation of the molds to the heat treatment of the castings.

14-253. Convection Currents in Gray Cast Iron. J. H. Schaum. *Foundry*, v. 75, Sept. 1947, p. 66-69, 192, 194, 198, 200.

Influence of convection currents from observations of segregation, shrinkage, and temperature from the side feeding of steel castings.

14-254. How to Prevent Snagging Wheel Breakage. R. B. Fair. *Foundry*, v. 75, Sept. 1947, p. 70-72, 180, 182, 184, 186.

Causes for wheel breakage in the snagging room are rough handling, poor machine condition, improper grinding practice, and improper mounting. How these can be avoided.

14-255. Gas and Shrinkage in Tin Bronzes. E. F. Tibbetts. *Foundry*, v. 75, Sept. 1947, p. 74-77, 164, 168, 170, 172, 175.

The similarity in appearance of gas and shrinkage when present in small amounts and the serious effect of such slight unsoundness on physical properties and pressure tightness.

14-256. Fundamentals of Molding Machines. Elmer A. Blake. *Foundry*, v. 75, Sept. 1947, p. 78-83.

Applications of different types of molding machines.

14-257. Heat Absorption of Molding Sand. Harry W. Dietert, Edward J. Hasty and R. L. Doelman. *Foundry*, v. 75, Sept. 1947, p. 84-85, 228, 230, 232.

Measuring and results of the heat conductivity of rammed molding sand specimens 4 in. in diameter and 1 in. in thickness, of specified physical properties.

14-258. Effect of Pouring Temperature on Test Bar Properties of 85-5-5-5 Alloy. L. W. Eastwood and J. G. Kura. *Foundry*, v. 75, Sept. 1947, p. 86-88, 175, 178-179.

The average and representative individual effects of pouring temperature on properties of test bars of five different designs poured from various melts.

14-259. Selecting Proper Pattern Equipment. Ray Olsen. *Foundry*, v. 75, Sept. 1947, p. 93, 215-216.

Patterns can be constructed of several different materials and in a number of different fashions.

14-260. Surface Quality in Alloy Steel Castings as Affected by Sand Mixtures and Mold Washes. H. E. Crivan. *Metal Treatment*, v. 14, Summer 1947, p. 84-92.

Some experiments in this field. Special consideration is given to the requirements of 13% manganese steel.

14-261. Current Views on Precision Casting. *Foundry Trade Journal*, v. 82, Aug. 14, 1947, p. 337-342.

Discussion of two papers presented at the Nottingham I.B.F. Conference. Mold coating; present limitations of the process; hot tears; casting threaded work; the Shaw method; production costs; multiple molds; joining pattern and feeding heads.

14-262. Pinhole Porosity; Investigations With Aluminum Alloy Castings. C. C. Griffin and L. G. Stephens. *Metal Industry*, v. 71, Aug. 15, 1947, p. 123-125; Aug. 22, 1947, p. 150-152.

Effects of water vapor whether produced from the combustion of gas or oil or derived from the air; the use of a flux which has the power to dissolve and combine with the Al_2O_3 skin.

14-263. Die-Casting Inserts. J. L. Erickson. *Metal Industry*, v. 71, Aug. 15, 1947, p. 129-130.

Recommended techniques for magnesium alloy castings.

14-264. Continuous Casting. H. Kastner. *Metal Industry*, v. 71, Aug. 15, 1947, p. 131-132.

Review of German developments in the nonferrous field. (Concluded.)

14-265. Practical Aspects of Gray Iron Inoculation. E. V. Somers and D. W. Gunther. *Iron Age*, v. 160, Sept. 4, 1947, p. 72-75.

Explains, from the practical foundryman's viewpoint, what inoculation is, how and where it can be most profitably applied, its effect, and types of inoculants available.

14-266. Modernized Foundry to Make It a Better Place to Work. *Factory Management and Maintenance*, v. 105, Sept. 1947, p. 74-76.

New installations at U. S. Rubber Co., Shoe Hardware Div., Waterbury, Conn.

14-267. Small Bushing With Green Sand Cores. *Foundry Trade Journal*, v. 82, Aug. 21, 1947, p. 370.

Bronze bushings can be made vertically without the use of dried cores by the employment of a simple stripping plate.

14-268. Mobile Pig-Casting Machine. *Engineering*, v. 164, Aug. 22, 1947, p. 176-177.

Machine for continuous casting of iron, lead, aluminum, and other nonferrous metals and alloys, manufactured by British firm.

14-269. Nonuniformity of Mechanical Properties of a ND-DKI Cast Steel Turbine Cylinder. V. P. Desnitskii. *Boiler and Turbine Manufacture (U.S.S.R.)*, April 1947, p. 24-26. (In Russian.)

Mechanical properties of samples taken from various sections of a cast turbine cylinder. Drawings show the location of the various test specimens.

14-270. An Analysis of Surface Quality of Zinc-Base Die Castings. A. W. Sundwick. *Steel*, v. 121, Sept. 15, 1947, p. 94-95, 136, 138-143.

Causes of various surface imperfections such as chills, splashing, gateholes, cold-laps, soldering, and swirls as they are influenced by die design and by variations in alloy composition.

14-271. The Story of a Fan. F. L. Culver. *Die Castings*, v. 5, Sept. 1947, p. 51-52.

Production of combination motor support and cooling fan. Sand casting was a complicated operation, requiring machining and hand cleaning, and quality was poor. Permanent mold casting produced a better fan, but still inferior from functional and cost standpoints. Die casting proved to be less expensive and to have other advantages.

14-272. Modern Foundry Layout Gives Clean Working Conditions. *Automotive Industries*, v. 97, Sept. 15, 1947, p. 41.

Layout of Freeport Works of Fairbanks, Morse and Co. This foundry pours only one type of metal—an electric-furnace cast iron from machine-shop chips and turnings, gates, and sprues.

14-273. Casting Steel Mill Rolls. *Steel*, v. 121, Sept. 22, 1947, p. 80-82, 112.

Procedures and equipment used by Mackintosh-Hemphill Co., Pittsburgh.

For additional annotations indexed in other sections, see:
2-222; **9**-112; **27**-207.

334 brief digests covering all published developments in this field during 1946 appear in Vol. 3, ASM Review of Metal Literature. Vols. 1, 2 and 3 together give you three-year index to the metal industry. Each Vol. $10.00 to ASM Members. $15.00 to Nonmembers. American Society for Metals, 7301 Euclid Ave., Cleveland 3.

15 SALVAGE AND SECONDARY METALS

15-29. Melting Aluminum Scrap in the Low Frequency Induction Furnace. Manuel Tama. *Iron Age*, v. 160, Sept. 4, 1947, p. 76-79.

A technique developed at Scovill Mfg. Co. resulted in an average recovery rate of 96%; the characteristics of oxide-coated particles and their effect on heat transfer in the furnace.

15-30. Reconditioning Heater Tubes at Gulf's Port Arthur Plant. R. B. Tuttle. *Oil and Gas Journal*, v. 46, Sept. 13, 1947, p. 90, 93.

Procedures and equipment used to recondition steel tubing retired from fired-heater oil-refinery service.

15-31. Treating Cyanide Waste From Metalworking Plants. *Steel*, v. 121, Sept. 15, 1947, p. 93, 112, 114, 117.

Use of chlorine for oxidation of cyanide waste.

15-32. How to Recondition Worn Shafts and Rods. *Power*, v. 91, Aug. 1947, p. 124.

Procedures involving lathe dressing, welding, metal spraying, and removal of excess metal.

15-33. Reclamation in a Primary Smelter of Copper From Brass Shell Cases. W. B. Boggs. *Canadian Institute of Mining and Metallurgy Transactions* (bound with *Canadian Mining and Metallurgical Bulletin*), v. 50, Aug. 1947, p. 445-447.

Difficulties encountered in a primary smelter which was not designed to treat scrap metals.

For additional annotations indexed in other sections, see:
22-525.

31 brief digests covering all published developments in this field during 1946 appear in Vol. 3, ASM Review of Metal Literature. Vols. 1, 2 and 3 together give you three-year index to the metal industry. Each Vol. $10.00 to ASM Members. $15.00 to Nonmembers. American Society for Metals, 7301 Euclid Ave., Cleveland 3.

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Quarter-Century Club Adds Members

Fifty-one members of seven chapters have become eligible for the Quarter Century Club. Names of these members, who have been presented with framed certificates attesting to continuous membership in the society for 25 years, are listed below.

Calumet Chapter

Standard Forgings Corp. (sustaining membership).

New Haven Chapter

Thomas G. Besom, Fred J. Dawless, Harold Fish, James A. Grover, Rolland G. Hall, J. A. Hutchinson, Henry G. Keshian, C. H. Mathewson, Arthur Phillips, S. C. Spalding, W. N. Van Tassel.

Northwest Chapter

A. E. Anderson, Wm. S. Getchell, W. E. Johnston, Wm. S. Sweet.

Ontario Chapter

F. E. Gardiner, James G. Morrow, M. F. Verity.

Pittsburgh Chapter

A. D. Beeken, Jr., V. W. Bihlman, Lloyd D. Bowman, W. Z. Burns, Fort Pitt Steel Casting Division (sustaining membership), James P. Gill, S. L. Goodale, R. C. Heaslett, G. Elkins Knable, Latrobe Electric Steel Co. (sustaining), John N. Ludwig, Jr., R. H. Noderer, W. H. Phillips, Rodman Chemical Co. (sustaining), Harry Schultz, Howard Scott, Du Ray Smith, Jr., Albert R. Stardardter, J. A. Succop, H. L. Walker, Clarence E. Wise.

Rochester Chapter

John J. Desmond, Lloyd K. Marshall, Frank McDonald, I. L. Nixon, R. C. Schwarz, Leon Slade.

Washington Chapter

Thomas E. Hamill, Henry S. Rawdon, C. A. Remsen, Samuel J. Rosenberg.

Pressure Welding Described

Reported by Marvin E. Hansell
Rose Polytechnic Institute

The opening fall meeting of the Terre Haute Chapter on Sept. 8 was addressed by A. R. Lytle of Union Carbide & Carbon Co. Mr. Lytle spoke on "Oxy-Acetylene Pressure Welding", telling how this time and labor-saving method is used for welding rail, pipe and other products. Slides and a film served as illustrations.

Control Valve Designed

The Piston Engineered Valve Co., Pittsburgh, a company recently organized by a group of instrument engineers with S. G. Raftis as vice-president, has announced that production will commence shortly on a pneumatic piston-operated control valve, designed by members of the firm.

Engineering Education

(Continued from page 27)

tower enjoys his privileges because a workable society supports him. A graduate of an institution such as this would be a very poor engineer indeed (and a very poor citizen) if his understanding of social-humanistic matters were limited or of little use.

Now I really should say that a good teacher doesn't, in fact, teach, as the layman commonly thinks. The best teacher is he who helps a student to learn. Teachers are for you only passing experiences. *You stand alone*, when you work and when you develop in your profession. You succeed insofar as you have learned, on a solid base of fundamentals, to think and to grow. That responsibility of thinking and working alone you must now begin to develop, with your teachers as your coaches.

It seems appropriate to me that you are here; studying the science, the art, the humanity of engineering, in an institution in a great city upon whose engineering accomplishments throughout the last hundred years so much of this nation has been built. We are a nation of engineers, above all other nations, and we must continue to lead. Our task, and more especially your task, is to see that you take a powerful position in the great engineering profession of America.

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ALUMINUM CLEANER NE—A highly detergent non-etching type aluminum cleaner.

CLEANER 100—A powerful alkali material for soak or electrolytic cleaning of steel.

BRASS CLEANER—A buffered alkali cleaner for most nonferrous metals including copper, brass, lead and tin.

CLEANER SW-52—An alkali detergent for fast cleaning in spray washing machines.

ZINC CLEANER #20—An anodic cleaner for preparing zinc base die castings for electroplating.

EMULSION CLEANER 75—A powerful new emulsifiable solvent cleaner safe for the plating room.

COMPOUND 87—A water-wash spray booth compound.

INHIBITOR 7C—A complete inhibitor for hot and cold hydrochloric acid pickles.

ACID ADDITION AGENT—A surface active material for better pickling of iron and steel. Reduces foaming and attack upon base metals.

SURPREP—A solvent phosphoric acid cleaner for preparing steel for painting.

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16 FURNACES AND FUELS

16-107. The Use of Producer Gas in the Production of Steel Castings. B. Evans. *Machinery Lloyd (Overseas Edition)*, v. 19, July 19, 1947, p. 99-101.

Development of use of producer gas in production of steel castings at P. R. Jackson's in England.

16-108. Ignitron Converters for Induction Heating. R. J. Ballard and J. L. Boyer. *Proceedings of the National Electronics Conference*, v. 2, 1946, p. 455-469.

A new type of ignitron frequency converter for melting furnace and forging heater application. Emphasis is on circuits.

16-109. Heat Losses in Furnace Linings. Part II. J. D. McCullough. *American Gas Journal*, v. 167, Aug. 1947, p. 36-38.

Data for making heat loss calculations for industrial gas-fired furnaces and ovens of three types: continuously fired, intermittently operated, and those shut down weekly.

16-110. Dielectric Loss at High Frequency. J. B. Whitehead. *Electrical Engineering*, v. 66, Sept. 1947, p. 907-910.

In application of dielectric heating to various industrial processes, alternating frequencies between 1 and 30 mc., and rates of temperature rise of 50° F. and upward, are common. The measurement of dielectric properties of a material under such varying conditions by a calorimetric substitution method.

16-111. Universal Control of Induction Heater. Austin B. Shields. *Machine Design*, v. 19, Sept. 1947, p. 147-148.

Progressive heating fixture which automatically cycles and controls induction heating operations.

16-112. Characteristics of Basic Gas Combustion Equipment. D. A. Campbell. *Steel*, v. 121, Sept. 22, 1947, p. 78-79, 103-104, 106, 108.

Compares techniques, defines terms, and presents formulas for design and use of various kinds of mixers and burners for industrial installations.

16-113. Induction Heating Steps-Up Desoldering Operations. *Steel*, v. 121, Sept. 22, 1947, p. 96.

East Ohio Gas Co., Cleveland, uses an induction heating unit to remove solder from gas meters during maintenance work. Technique results in large savings of time.

16-114. "Infrared" Heating by Gas—Its Development and Practice Today. J. B. Carne. *Metallurgia*, v. 36, Aug. 1947, p. 193-196.

Applications; development; gas units; fundamental principles; subsidiary advantages; the heat-transfer problem. (To be continued.)

16-115. Electric Resistance Type Appliances. Victor Paschkis. *Industrial Heating*, v. 14, Sept. 1947, p. 1432-1434, 1436, 1438, 1440, 1442, 1444, 1448.

Direct and indirect types of electrically heated furnaces. (Part of a series.)

For additional annotations indexed in other sections, see: 18-190; 22-477.

135 brief digests covering all published developments in this field during 1946 appear in Vol. 3, ASM Review of Metal Literature. Vols. 1, 2 and 3 together give you three-year index to the metal industry. Each Vol. $10.00 to ASM Members. $15.00 to Nonmembers. American Society for Metals, 7301 Euclid Ave., Cleveland 3.

17 REFRACTORIES Furnace Materials

17-77. Progress Report on Carbon Linings for Blast Furnaces. V. F. Nolan. *Refractories Journal*, v. 23, July 1947, p. 256-262.

Thirteen blast furnaces in operation in the United States have hearths built completely of carbon blocks or bricks, or lined with courses of shaped carbon. Since some of these hearths have been in blast for as long as fifteen months, a number of questions relative to their durability and operating characteristics can now be answered.

17-78. The Stability of Carbon Bricks in Carbon Monoxide. T. W. Howie and J. Mackenzie. *Transactions of the British Ceramic Society*, v. 46, July 1947, p. 161-173; discussion, p. 173-176.

A study of the action of CO on experimental carbon bricks with additions of iron and iron oxide (Fe_2O_3) and on three commercial brands of brick.

17-79. Reactions Occurring in Refractory Materials Involving Ferrous Oxide and Magnesia. G. H. B. Lovell, G. R. Rigby, and A. T. Green. *Transactions of the British Ceramic Society*, v. 46, July 1947, p. 200-206.

Reactions of FeO with magnesium aluminate, silicate, and chromate were studied at 1400 °C. All three reactions are similar in that they involve mutual replacement between magnesium and ferrous ions. Appendix by W. F. Ford gives results of X-ray examination of the reaction products.

17-80. Workability Index of Fireclay Refractories. *Technical News Bulletin (National Bureau of Standards)*, v. 31, Aug. 1947, p. 94-95.

Workability of a plastic refractory should be based on the amount of work required to reach maximum bulk density rather than on a deformation test. Need for standardization of the method of test.

17-81. Basic Ports and Roofs in European Openhearth Furnaces. Pierre Bettembourg. *Metal Progress*, v. 52, Sept. 1947, p. 403-410. (Translated from the French.)

The characteristics and construction and maintenance techniques for basic ports and roofs. Deals with chrome-magnesia brick only, and specifically with "Radex E", the type most widely used on the Continent. Use of basic refractory brick in openhearth furnaces has increased production while reducing fuel consumption and increasing the life of furnace linings.

17-82. Basic Openhearth Furnace Refractories and Masonry. Part II. *Industrial Heating*, v. 14, Sept. 1947, p. 1506, 1508, 1510.

A discussion at the recent 30th conference of the National Open Hearth Committee, A.I.M.E. Trends in bottom construction, checkers, and mixer linings. (Concluded.)

17-83. Conservation of Fuel Through Proper Selection of Furnace Refractories. *Industrial Heating*, v. 14, Sept. 1947, p. 1512.

Paper by J. D. McCullough presented to the school of industrial gas engineers conducted by the American Gas Association, Columbus, Ohio.

17-84. Fully Rammed Versus Partly Rammed Versus Dead-Burned Magnesite Bottoms. J. J. Golden. *Industrial Heating*, v. 14, Sept. 1947, p. 1514-1515.

Condensation of paper presented at recent National Open Hearth Conference of A.I.M.E., Chicago.

For additional annotations indexed in other sections, see: 16-109; 23-337; 27-217.

18 HEAT TREATMENT

18-182. The Effect of Stabilizing and Stress Relief Heat Treatment on Welded 18-8 Stainless Steel. Wilson G. Hubbell. *Aircraft Engineering*, v. 19, July 1947, p. 225-226, 227-228.

Tests were designed to determine the particular benefits, if any, which might be imparted by these processes to 18-8 Type 321 and Type 347 stainless steels for exhaust manifolds.

18-183. Precipitation Hardening. Part V. L. Sanderson. *Chemical Age*, v. 57, Aug. 2, 1947, p. 151-152.

Commercial application and normal process. (Concluded.)

18-184. Effect of Stabilizing and Stress Relief Heat Treatment for 18-8 Stainless. Wilson G. Hubbell. *Steel*, v. 121, Aug. 25, 1947, p. 86-88, 114, 119.

Serviceability tests on welded aircraft exhaust manifolds indicate that by heating titanium and columbium-stabilized Types 321 and 347 steels for 30 min. at 1650° F., some small beneficial results are realized—improved resistance to attack by corrosive aqueous solutions and electrolytes.

18-185. The Foundry Data Sheet September 1947; Glossary of Terms Employed in Heat Treating Operations. *Foundry*, v. 75, Sept. 1947, p. 123-124.

A set of definitions that does not include temperatures.

18-186. Practical Aspects of Surface Hardening Methods. H. E. Boyer. *Iron Age*, v. 160, Aug. 28, 1947, p. 74-78.

Possibilities and limitations of pack carburizing, liquid carburizing, gas carburizing and nitriding; the applications for which each is most suitable; the advantages and limitations of gas carburizing and nitriding. Precautions to be observed. (Concluded.)

18-187. Application of Induction Heating to Various Large Objects. V. A. Troitsnogo. *Industrial Power (U.S.S.R.)*, v. 4, June 1947, p. 11-12. (In Russian.)

Heat treating four different massive metal parts, for instance large gear wheels.

18-188. Quenching Media. R. E. W. Gunn. *Journal of the Iron and Steel Institute*, v. 156, Aug. 1947, p. 524.

A simplification of the calculation described by F. W. Jones and W. I. Pumphrey (May issue).

18-189. Practical Aspects of Bainitic Hardening of High-Speed Steel. C. K. Baer and A. E. Nehrenberg. *Iron Age*, v. 160, Sept. 4, 1947, p. 65-70; Sept. 18, 1947, p. 77-82.

Improvements in performance qualities of high speed steel cutting tools were made possible by the development of a new method of heat treating. Metallurgical aspects and comparison with conventional hardening practice. Bainite formation data are based on microstructural, specific volume, length change, and hardness test methods. Laboratory and service data show improvements resulting from use of the method. Cutting efficiency of primary and secondary bainite compared. 21 ref.

18-190. Heat Treating by Electric Salt Bath Furnace Process. *Canadian Metals & Metallurgical Industries*, v. 10, Aug. 1947, p. 21-22.

Unusual features of a modern Upton electric salt bath furnace installation.

18-191. Lämpliga Temperaturer och Tider för Etappglödgning. (Suitable Temperature and Time for Cycle Annealing.) K. O. Nordin and E. Tholander. *Jernkontorets Annaler*, v. 131, no. 7, 1947, p. 243-258.

Study of the literature on the isothermal transformation of austenite in order to coordinate data for cycle annealing. 46 ref.

(Turn to page 32)

Chicago Announces Educational Series

The Fall Fundamental Series in the Chicago Chapter's 1947-48 educational program opened on Oct. 13 with the first of six lectures on "Metallurgical Functions in Manufacturing Processes". This series of lectures is planned to cover the basic metallurgical functions encountered in the typical manufacturing plant. The lectures are designed not only for metallurgists, but also for engineers, foremen, tool designers, and purchasing agents, who are interested in increasing their knowledge of the wide field covered by the working of metals.

At the opening lecture on Oct. 13 M. L. Frey, assistant to general works manager, Allis-Chalmers Mfg. Co., spoke on "Raw Material Selection". Other lecturers and subjects are as follows:

Oct. 27—Specifications, by Ralph O. N. Erlandson, service metallurgist, Carnegie-Illinois Steel Corp.

Nov. 3—Incoming Inspection of Raw Materials, by William H. Jennings, raw materials engineer, Western Electric Co.

Nov. 17—Effect of Composition and Properties of Raw Material Upon Machining Problems, by H. A. Young, assistant chief metallurgist, Crane Co.

Nov. 24—Effect of Composition and Properties of Raw Material Upon Draw Press Problems, by W. J. Guyer, founder, Guyer Metal Products Corp.

Dec. 1—Effect of Composition and Properties of Steel Upon Heat Treat Problems, by H. B. Knowlton, materials engineer, International Harvester Co.

The Seminar Series of the Chicago Chapter's annual educational activities will open in January. Subjects to be discussed this year are: formation and the properties of martensite in relation to martempering; nonmetallic inclusions in steel; properties of steel at high temperatures; and physical properties of cold drawn steel.

Edsall Goes to Eutectic

Howard Linn Edsall has joined Eutectic Welding Alloys Corp., New York, as director of public relations, in charge of advertising and sales promotion. Mr. Edsall is completing a three-year term as a member of the *Metal Progress* Advisory Board. He was formerly with Radio Corp. of America, but left there in 1946 to devote his attention to writing and book publishing.

Induction Heating Corp. Moves

The Induction Heating Corp., manufacturers of Ther-Monic induction and dielectric heating equipment, has moved to its recently completed quarters at 181 Wythe Ave., Brooklyn 11, N. Y. It will occupy the entire second floor in a modern brick and concrete building, an area more than twice the size of its former plant. Particular attention has been given to the enlarged and more fully equipped laboratories.

New Rome Chapter Holds First Fall Meeting

Reported by M. G. Steele

Vice-President in Charge of Engineering Kent Electric Corp.

The first fall meeting of the newly organized Rome (N. Y.) Chapter of the American Society for Metals was held on Sept. 3 with Louis A. Carapella as the principal speaker. Dr. Carapella is senior industrial fellow on the Magnesium Multiple Fellowship sustained by the National Lead Co. at Mellon Institute of Industrial Research in Pittsburgh. He spoke on "Fundamental Alloying Principles".

Two formal meetings of the Rome Chapter were held last spring, and a charter was authorized by the Board of Trustees in the early summer. Present officers of the chapter, elected last spring, are:

Chairman—R. Carson Dalzell, Revere Copper and Brass, Inc.

Secretary-Treasurer—L. H. Decker, Revere Copper and Brass, Inc.

Chairman of the Program Committee—Lloyd R. Dickinson, Kent Electric Corp.

Executive Committee—L. E. Gibbs, C. E. Thayer, G. J. Rich, M. G. Steele, R. C. Graham, and W. E. Moulton.

The Group now has 64 members from Rome, Utica, the Mohawk Valley, Oneida and other communities in this area. In the Executive Committee meeting which preceded Dr. Carapella's talk, committees for the season were named and plans laid for future chapter activities.

Col. Fletcher Leaves Army Joins Sam Tour & Co.

Col. Leslie S. Fletcher has joined Sam Tour & Co., Inc. and American Standards Testing Bureau, Inc., New York City, as technical director. He is being retired from the U. S. Army on completion of 23 years commissioned service.

L. S. Fletcher

A graduate of West Point Military Academy, Col. Fletcher also studied at M.I.T. and Watertown Arsenal. From 1936 to 1942, he was at Frankford Arsenal, being officer in charge of the laboratory for the last four years there. He also saw four years of overseas duty in both zones, and received the Bronze Star Medal with Oak Leaf Cluster and the Army Commendation Ribbon.

Col. Fletcher has been active in chapter affairs of the American Society for Metals, and has served on several A.S.T.M. committees besides being a member of A.I.M.E.

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18-192. Appliances Used in Heat Treatment Operations. *Machinery Lloyd (Overseas Edition)*, v. 19, Aug. 16, 1947, p. 87-89.

Nichrome boxes, racks, and fixtures.

18-193. Carbo-Nitriding of S.A.E. Steel Parts. Walter H. Holcroft. *Metal Progress*, v. 52, Sept. 1947, p. 380-386.

Clean hardening of finished alloy steel parts with a light case and with minimum size change. The atmosphere used was 20% CO, 40% H_2, and 40% N_2 plus metered amounts of a hydrocarbon gas and ammonia.

18-194. Continuous Scale-Free Heat Treatment of Curtiss Electric Propeller Hubs. *Industrial Heating*, v. 14, Sept. 1947, p. 1412-1414, 1416, 1418, 1420, 1422.

Equipment and procedures. (To be continued.)

18-195. Applications of the Science of Gas Chemistry to Heat Treating Processes. O. E. Cullen. *Industrial Heating*, v. 14, Sept. 1947, p. 1450, 1452, 1454, 1456, 1458.

Condensation of a paper presented to the Industrial and Commercial Gas Section, American Gas Association, at a recent conference in Boston.

18-196. Electronic Heating Expedites Production of Milk Cans. *Industrial Heating*, v. 14, Sept. 1947, p. 1460.

Annealing the necks of the cans.

18-197. Commercial Work Handled by Plant of Fred Heinzelman & Sons Since 1917. Part II. *Industrial Heating*, v. 14, Sept. 1947, p. 1518-1520, 1522, 1524, 1526.

Concluded.

18-198. The Metallographic Constituents of Steels and Cast Iron as Affecting Flame Hardening. O. M. Harrelson. *Welding Journal*, v. 26, Sept. 1947, p. 771-775.

Factors which control hardenability of ferrous metals; methods for surface flame hardening.

18-199. The Effect of Stress Relief Heat Treatment on the Technical Properties of Structural Steels and Structural Elements. Otto Graf. *Welding Journal*, v. 26, Sept. 1947, p. 517s-518s.

Results of bend tests of welded beams at the Stuttgart Technical College and elsewhere. (Translated and condensed from *Stahlbau*, v. 17, 1944, p. 65-68.)

For additional annotations indexed in other sections, see: 22-462-477; 23-299; 24-257; 27-181-194-199-202-206-215.

274 brief digests covering all published developments in this field during 1946 appear in Vol. 3, ASM Review of Metal Literature. Vols. 1, 2 and 3 together give you three-year index to the metal industry. Each Vol. $10.00 to ASM Members. $15.00 to Nonmembers. American Society for Metals, 7301 Euclid Ave., Cleveland 3.

19 WORKING—Rolling, Drawing, Forging

19-281. Battleship Technique Used in New Atom Cyclotron Part. P. D. Aird. *Modern Industrial "Press"*, v. 9, Aug. 1947, p. 13-14, 16.

Steel forgings of a size and shape rarely attempted have been successfully produced at the Homestead works of Carnegie-Illinois Steel Corp., for a giant cyclotron magnet to be installed in an atom smasher.

19-282. Designing of "Trouble-Free" Dies. Part LXXII. Die for Cutting Interior Scallops. C. W. Hinman. *Modern Industrial "Press"*, v. 9, Aug. 1947, p. 18, 20.

How die with scallops should be designed and some problems which may be encountered.

19-283. More Expensive Dies for Less Expensive Products. E. V. Crane. *Modern Industrial "Press"*, v. 9, Aug. 1947, p. 22, 24, 26.

The mass production methods of metalworking processes use carefully tooled equipment of great strength, and take advantage of the plastic properties of metals to produce an infinite variety of parts and articles at unbelievably small cost.

19-284. Carbide Sheet Metal Dies. Earle Glen. *Western Machinery and Steel World*, v. 38, Aug. 1947, p. 69-73.

Differences between dimensional designs of carbide and steel dies. Where a large die investment is involved, a try-out die is made of steel and then duplicated in carbide. This permits modifying the original design before the carbide die (with its long life of 20 or more times that of steel) is produced.

19-285. The Rolling of Metals: Theory and Experiment. Part XIV. Methods Used in Practice for the Calculation of Rolling Load and Horsepower. L. R. Underwood. *Sheet Metal Industries*, v. 24, Aug. 1947, p. 1563-1568, 1580.

Compression rate curves for various rolling temperatures; and horsepower hours per ton rolled and elongation curves.

19-286. The Physics of Sheet Steel. G. C. Richer. *Sheet Metal Industries*, v. 24, Aug. 1947, p. 1572-1580. (Continued.)

The origin of ferromagnetism; the magnitudes of magnetization; the ferromagnetic structure, ordered regions and disordered regions. (To be continued.)

19-287. Hydraulic and Mechanical Presses for Sheet Metal Drawing. J. A. Grainger. *Sheet Metal Industries*, v. 24, Aug. 1947, p. 1587-1590.

Reply to the recent discussion of presses and press design.

19-288. The Pressing of Stainless Steel Exhaust "U" Pipes and Shrouds. T. W. Elkington. *Sheet Metal Industries*, v. 24, Aug. 1947, p. 1603-1608.

Blanking, pressure forming, restriking and trimming.

19-289. Tungsten Wires; an Electrolytic Method of Pointing. W. G. Pfann. *Metal Industry*, v. 71, Aug. 8, 1947, p. 110, 112.

A simple, rapid and flexible method of pointing tungsten wire, requiring only elementary apparatus.

19-290. Shaping and Forming. Willibald Trinks. *Blast Furnace and Steel Plant*, v. 35, Aug. 1947, p. 964-970, 974, 1003, 1008.

Shaping and forming plastic bodies. Recrystallization temperatures and speeds, tension limitations, variables affecting deformation, and forging problems.

19-291. Combined Stamping Operation. E. V. Crane. *Steel*, v. 121, Aug. 25, 1947, p. 102, 120.

How both automatic feeding and multiple-operation tooling require for success a sound understanding of metalworking theory and careful attention to detail. Any of the typical operations can be put together in a suitable sequence to produce most parts in more or less finished form at one pass.

19-292. Wire Mill Practice; Instructions on the Calculation of Die Sets. W. F. G. Kerley. *Wire Industry*, v. 14, Aug. 1947, p. 443.

Procedure for calculation.

19-293. How and Why. *Machinery (London)*, v. 71, Aug. 7, 1947, p. 154-155.

Production of small brass caps by extrusion; mass production of socket wrenches.

19-294. The Strengthening of Steel by Correct Hot Working Conditons. K. F. Grachev. *Engineers' Digest (American Edition)*, v. 4, June 1947, p. 286.

Results of experimental investigation; practical conclusions. (Translated and condensed from *Vestnik Mashinostroenia*, no. 5-6, 1946, p. 71-73.)

19-295. New Press Tooling Speeds Hardware Production. W. J. Donaghey. *Iron Age*, v. 160, Aug. 28, 1947, p. 58-60.

Designed specifically to meet tremendous production demands for manufacture of escutcheon plates. Equipped with two crankshafts operating seven plungers and a toggle unit for coining. An ingenious die for assembling brass scalps to glass doorknobs.

19-296. Cemented Carbide Used for High Production Dies and Punches. *Iron Age*, v. 160, Aug. 28, 1947, p. 64-66.

The selective application of cemented carbide in high production dies and punches at areas subjected to high wear forces offers a means of greatly increasing die runs and boosting the number of parts produced per grind.

19-297. Heating and Rolling Low Carbon Steel for Strip. N. E. Rothenthaler. *Iron and Steel Engineer*, v. 24, Aug. 1947, p. 71-76; discussion, p. 76-78.

Modern technique employed to properly heat and roll steel from ingots into slabs, and from slabs into coiled strip.

19-298. Raising the Creep Limit by Cold Working. *Brown Boveri Review*, v. 33, Sept. 1946, p. 227-233.

Cold working of an annealed material produces a stiffening effect, that is, raises the strength values and increases hardness. In this way it is possible to extend the elastic range of the stress-strain diagram, in other words, to raise the point at which strain or permanent set is initially exhibited under stress. 15 ref.

19-299. Aluminum Foil. *Metal Industry*, v. 71, Aug. 22, 1947, p. 153.

Production methods employed by German technicians. (Abstracted from a recent B.I.O.S. Report.)

19-300. Auto Brake Disks Produced With Progressive Dies. Herbert Chase. *Iron Age*, v. 160, Sept. 4, 1947, p. 80-82.

Stamping of Buick brake disks in a transfer setup employing four dies in a single press. Operation of a simple stacking device which greatly facilitates the handling of circular blanks from a press.

19-301. Expanding Pipe Beyond Yield Point to Make It Rounder and Stronger. *Engineering News-Record*, v. 139, Sept. 4, 1947, p. 86-87.

How steel pipe for a natural gas line is hydraulically expanded from 29½ in. to 30 in. diameter. Additional strength results from cold working the steel.

19-302. Unconventional Dies Facilitate Difficult Forming Operations. Gerald Eldridge Stedman. *Steel*, v. 121, Sept. 8, 1947, p. 78-79, 120.

Methods and equipment used in production of toasters in St. Louis plant of Knapp-Monarch Co.

19-303. Technical Progress in the Wire Industry. R. S. Brown. *Wire and Wire Products*, v. 22, Sept. 1947, p. 658-664.

Historical review.

19-304. The Aetna Wire Drawing Unit. Part II. E. J. P. Fisher and A. L. Thurman. *Wire and Wire Products*, v. 22, Sept. 1947, p. 665-668, 679-681.

Capacities of this unit for different types and sizes of wire.

19-305. Modernized Control System Increases Blooming Mill Output. Erling Frisch. *Steel*, v. 121, Sept. 15, 1947, p. 120, 122 125.

How reduction in time required to reverse motor armature serving 44-in. blooming mill results in stepping up semifinished production.

19-306. A New Mechanized Forge. *Metallurgia*, v. 36, Aug. 1947, p. 175-178, 222.

Equipment and procedures used by British firm for the production of forgings from special steels.

(Turn to page 34)

Compliments

To R. H. FRANK, Bonney Floyd Co., Columbus, Ohio, on being elected president of the Electric Metal Makers Guild, Inc.; to A. J. SCHEID, JR., Columbia Tool Steel Co., Chicago Heights, Ill., on being elected vice-president of the same group; and to D. L. Clark, Simonds Saw and Steel Co., Lockport, N. Y., on being chosen secretary-treasurer.

To CARL E. HEUSSNER, head of the plating laboratory of Chrysler Corp., on his work in development of large nickel-plated diffusers for the separation of uranium^{235}. Also to Chrysler Corp. on the excellence of its booklet entitled "Secret" which describes this work.

To six veteran members of the staff of Battelle Memorial Institute, Columbus, Ohio, on their appointment to fill six newly created assistant directorships, namely, FRANK C. CROXTON, formerly head of the Institute's chemical research; CLARENCE H. LORIG, in charge of research in foundry technology; HOWARD W. RUSSELL, formerly chief physicist; RALPH A. SHERMAN, in the field of fuels technology; CLARENCE E. SIMS, head of research in process metallurgy; and JOHN D. SULLIVAN, in the field of both metals and ceramic industries.

To HARRY Y. MCCOOL, SR., superintendent of maintenance of the Timken Roller Bearing Co.'s Steel and Tube Division, on the completion of more than 31 years of service prior to his retirement Sept. 1.

To OSCAR BREWER, sales engineer of Leeds & Northrup Co., on the completion of nearly 39 years with that organization prior to his retirement.

To CHARLES E. NELSON, technical director of the magnesium division of Dow Chemical Co., on his selection to deliver the 1948 Charles Edgar Hoyt Lecture of the American Foundrymen's Association next May.

To FREDERICK SEITZ, head of the physics department, and ROMAN SMOLUCHOWSKI, associate professor of metallurgical engineering, Carnegie Institute of Technology, on their appointment to the newly organized Committee on Solid State in the Division of Physical Sciences of the National Research Council.

To H. G. CORNEJO-LOPEZ on his promotion from major to lieutenant-colonel in the artillery branch of the Peruvian Army. He received his M.S. degree from M.I.T. in 1944 and has done some ordnance work for the U. S. War Department.

To PAUL G. LUTZ of Standard Alloy Co. on his election as president of the Alloy Casting Institute, and to W. B. SULLIVAN of Lebanon Steel Foundry, elected vice-president. E. A. SCHOEFER was re-elected executive secretary and treasurer of the institute, H. A. COOPER of Cooper Alloy Foundry Co. and J. D. CORFIELD of Michigan Steel Casting Co. were elected to the board of directors, and H. S. AVERY of American Brake Shoe Co. was elected chairman of the technical research committee.

To J. B. NEIMAN, of Federated Metals Division, American Smelting and Refining Co., on his re-election as president of the Aluminum Research Institute.

Boston Chapter Holds Outing

The annual outing of the Boston Chapter was held at the Stow Country Club, Stow, Mass., Saturday, Sept. 20, under the able chairmanship of Morris Cohen of M.I.T.

Two hundred and twenty-three members and guests attended the event, which included golf, horseshoes, tennis, bowling, baseball, pingpong, banquet and entertainment. The New England Metallurgical baseball team defeated the Massachusetts Institute team. Entertainment was furnished by Ruth Tingley, accordion player, and her company of entertainers.

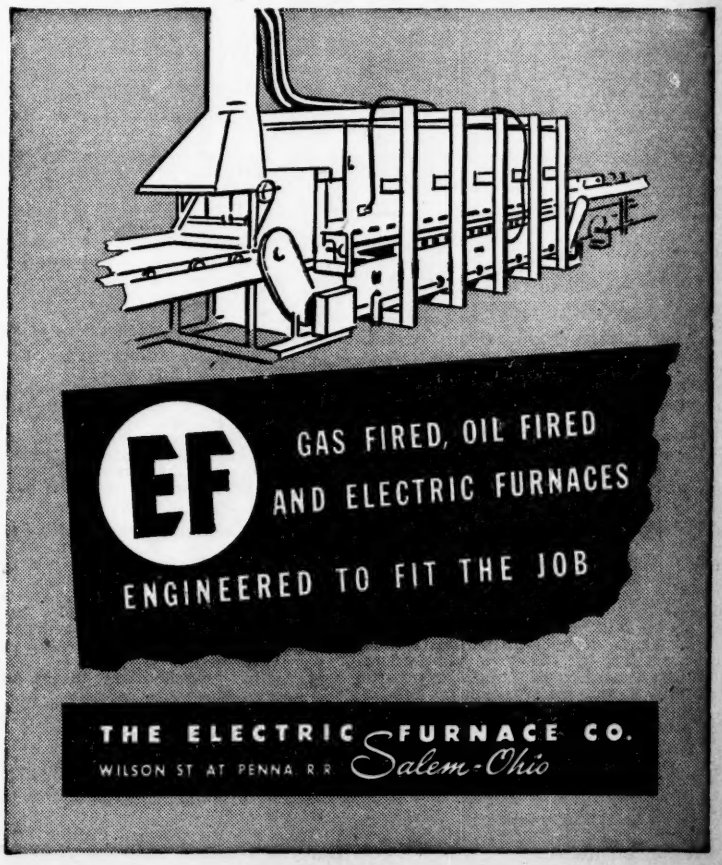
Age Hardening Theories Brought up to Date

Reported by George L. Barnard
Metallurgist
Los Alamos Scientific Laboratory

"Current Views on Age Hardening" were presented to the Los Alamos Chapter recently by Frank T. Sisco of Alloys of Iron Research. Various terms have been used to identify the phenomenon (such as precipitation hardening or dispersion hardening), but Mr. Sisco considers age hardening most appropriate.

Of the large number of systems in which age hardening takes place, Mr. Sisco chose the aluminum-copper system for his discussion. Slides showed that this system has an increasing solubility of the theta constituent from room to the eutectic temperature. The maximum hardness of a certain age hardening system can be shown to be best at a certain temperature for a certain length of time.

In conclusion, Mr. Sisco discussed the various theories of age hardening, including the original particle size theory, the knot theory, and the more recent concept of platelet precipitation.



19-307. The Forging of High-Temperature Alloys. *Industrial Heating*, v. 14, Sept. 1947, p. 1446, 1448.

Results reported by L. B. Fonda at recent annual meeting of A.S.M.E.

19-308. The Rolling of Metals: Theory and Experiment. Part XIV. Methods Used in Practice for the Calculation of Rolling Load and Horsepower. (Continued.) L. R. Underwood. *Sheet Metal Industries*, v. 24, Sept. 1947, p. 1769-1774, 1782.

Practical examples of the calculation of the rolling load, rolling horsepower, etc., in hot rolling; equivalent maximum torque, r.m.s. torque, and motor rating. (To be continued.)

19-309. Production Factors Affecting Grain Size in Aluminum Sheet. Raymond Chevigny. *Sheet Metal Industries*, v. 24, Sept. 1947, p. 1775-1781.

Effect of manufacturing conditions on the grain size of aluminum sheet. Rolling technique for the production of fine-grained material, with good working properties, from various grades of aluminum. (Translated from *Revue de l'Aluminium.*)

19-310. Practical Problems of Light Presswork Production. (Continued.) J. A. Grainger. *Sheet Metal Industries*, v. 24, Sept. 1947, p. 1789-1795.

Adjustment of an internal draw sleeve; safety instructions for press toolsetters and operators; care of tools, instruction of operators, location of blanks in dies. (To be continued.)

19-311. Plastic Straining. K. L. Jackson. *Sheet Metal Industries*, v. 24, Sept. 1947, p. 1795.

Application of plastic straining to the pressing of sheet metals.

For additional annotations indexed in other sections, see: 9-112; 23-284-296-316; 24-267-284-292; 27-197-207-215.

322 brief digests covering all published developments in this field during 1946 appear in Vol. 3, ASM Review of Metal Literature. Vols. 1, 2 and 3 together give you three-year index to the metal industry. Each Vol. $10.00 to ASM Members. $15.00 to Nonmembers. American Society for Metals, 7301 Euclid Ave., Cleveland 3.

20 MACHINING AND MACHINE TOOLS

20-486. The Electronic Method of Contouring Control. J. Morgan. *Proceedings of the National Electronics Conference*, v. 2, 1946, p. 239-249.

The problem of automatic contouring control, and its solution by a combination of electronic and magnetic circuits.

20-487. Brinell Hardness Versus Machining Index as a Criterion of Machinability. G. Schlesinger. *Machinery (London)*, v. 71, July 31, 1947, p. 122-127.

The first consideration in economical metal cutting is the selection of the right cutting speed which allows the work to be finished in the shortest time. Secondly, the tool should have a long life so that it will produce a large number of satisfactory parts before it requires regrinding. Results of tool life tests on steels of varying hardness, and cutting resistance tests.

20-488. Flairing Operation on the Automatic Screw Machine. C. H. Wummel. *Screw Machine Engineering*, v. 8, Aug. 1947, p. 40-42, 44.

Application of inexpensive yet effective tooling to both high and low volume production.

20-489. Rotary End Milling Attachment Eliminates Secondary Operation. *Screw Machine Engineering*, v. 8, Aug. 1947, p. 45, 48-50.

Advantages of RA 6 Acme Gridley bar machine. Demonstrates the sound fundamentals of using a double rise lead cam, high-speed drilling attachments, and combining operations to increase production.

20-490. Highlights on Threading. H. F. Wieler and R. E. Bender. *Screw Machine Engineering*, v. 8, Aug. 1947, p. 66-69.

Reasons for lead error; causes of tapered threads; floating a die head when the turret or spindle is out of alignment; insert chasers; the machinability of various kinds of metals.

20-491. A Basis for Improved Machine Tool Design. Phil Huber. *Production Engineering & Management*, v. 20, Aug. 1947, p. 51-54.

Some new developments over the past 12 years.

20-492. High Velocity Increases Die Life. *Production Engineering & Management*, v. 20, Aug. 1947, p. 60.

New high-speed punch press known as the Hypermatic and made by Lempco Products, Inc., Bedford, Ohio. Speeds up to 1800 strokes per min. are readily achieved. A rotary instead of a reciprocal motion is used to actuate the dies.

20-493. Standard Attachments Increase Versatility of Impact Tool. *Production Engineering & Management*, v. 20, Aug. 1947, p. 61.

New Ingersoll-Rand hand tool which will apply and remove nuts, drill, ream, tap, drive and remove screws, drive and remove studs, extract broken cap screws and studs, run wire brushes, do hole-saw work, drill brick and masonry and drive wood augers.

20-494. High-Frequency Tool Efficiency Depends on Maintenance of Torque. R. L. Gomon. *Production Engineering & Management*, v. 20, Aug. 1947, p. 62.

How the phenomenon of electric resonance, applied to voltage correction on high-frequency generators, helps the production rate of high-cycle tools.

20-495. The Crib. *Production Engineering & Management*, v. 20, Aug. 1947, p. 79.

Handy bench shear, by Edmund L. Johnson. Conserving diamonds, by Edward Diskavich.

20-496. Higher Production Possible on New "20" Grinding Wheel. *Production Engineering & Management*, v. 20, Aug. 1947, p. 86.

Advantages and applications of new abrasive wheels developed by Carborundum Co.

20-497. Hobbing Processes in Industry. John E. Hyler. *Steel Processing*, v. 33, Aug. 1947, p. 483, 486.

In the continuous process of machining known as hobbing, work is machined by the combined rotary motion of the cutter and the work. Different types of hobs.

20-498. Broaching Internal Clutch Teeth Automatically. C. W. Hinman. *Steel Processing*, v. 33, Aug. 1947, p. 489-490.

How an automatic broaching setup, using relatively simple broaches, can be designed to broach complex parts and effect substantial savings in production costs. In this operation internal involute gear teeth are automatically broached in heavy-duty clutch disks.

20-499. High Velocity Sawing. H. J. Chamberland. *Western Metals*, v. 5, Aug. 1947, p. 25-27.

High velocity sawing in comparison with friction sawing for cutting and shaping of aluminum, magnesium and related alloys.

20-500. How to Sharpen Cutting Tools. Harry S. Wharen. *American Machinist*, v. 91, Aug. 28, 1947, p. 101-120.

How to sharpen broaches, milling cutters, drills, tops, and single-point tools.

20-501. Unusual Applications of Superfinishing. E. L. Hemingway. *Machinery (London)*, v. 71, Aug. 7, 1947, p. 156-157.

Superfinishing of reamers and punches to improve results and life; of steam-valve disks and seats to reduce steam leakage; of pump piston-rods to eliminate the rasp effect between the rod and the nonmetallic packing; of gun recoil pistons to improve performance; of aircraft engine parts to stop scoring; and of diesel engine crankshafts and automobile tappet valves to improve smoothness where they contact mating parts. Inspection of metal surfaces.

20-502. Simple Device for Radius or Profile Turning. *Machinery (London)*, v. 71, Aug. 7, 1947, p. 157.

Shown diagrammatically.

20-503. Some Metallurgical Factors Which Affect Machinability With Special Reference to Intermittent Cutting. K. J. B. Wolfe. *Metal Treatment*, v. 14, Summer 1947, p. 103-110.

Comments on paper published in the Winter issue, contributed by H. S. Bavister, E. R. Gadd, D. Tabor, G. L. Talbot, and J. F. B. Jackson. Author's replies.

20-504. Internally Grooving Castings With a Special Tool. Robert Mawson. *Steel*, v. 121, Sept. 1, 1947, p. 80.

Diagram and description of method for machining a large unit housing.

20-505. Rapid Milling of Plates. *Industrial Power (U.S.S.R.)*, v. 4, June 1947, p. 7-8. (In Russian.)

An improved method of milling using negative cutting angles, for which large improvements in cutting rates and decreases in tool consumption are claimed.

20-506. Centerless Grinder Work Blade Life Lengthened. *Iron Age*, v. 160, Sept. 4, 1947, p. 79.

New blade developed by Cliff Co., Chicago, features a wearing surface of alternate sectional inserts of tungsten carbide separated by thin strips of alloy steel, laid in a slot with supporting walls of steel. Substantial reductions in blade costs are claimed.

20-507. Milling Fixture for Impulse Wheel. *Machinery (London)*, v. 71, Aug. 14, 1947, p. 183-184.

Detailed drawings show fixture designed for milling three different types of teeth in an impulse wheel at one setup of the machine.

20-508. Centering Machine and Electronically Controlled Grinder. *Engineering*, v. 164, Aug. 15, 1947, p. 152.

A British machine tool.

20-509. An Automatic Magazine Screwdriver. *Machinery Lloyd (Overseas Edition)*, v. 19, Aug. 16, 1947, p. 73-74.

Machine made in England.

20-510. Abrasive Wheel Cutting. H. Sanders. *Machinery Lloyd (Overseas Edition)*, v. 19, Aug. 16, 1947, p. 76-81.

Advantages, limitations, techniques, wheel types, design, and other factors.

20-511. Toolpost for Internal Screwcutting. *Machinery Lloyd (Overseas Edition)*, v. 19, Aug. 16, 1947, p. 84-85.

British attachment.

20-512. A New Gear Generating Machine. *Machinery Lloyd (Overseas Edition)*, v. 19, Aug. 16, 1947, p. 102-104.

A British machine tool.

20-513. Producing Tractor Gears. *Machinery (London)*, v. 71, Aug. 21, 1947, p. 199-205.

Methods employed by British firm.

20-514. Profile Turning. *Machinery (London)*, v. 71, Aug. 21, 1947, p. 206-207.

German and English methods for machining cams and similar work.

20-515. Gage Production on a Cone Center Grinding Machine. *Machinery (London)*, v. 71, Aug. 21, 1947, p. 207.

(Turn to page 36)

Deaths Take Wire Expert, Alcoa Head

Benjamin Lewis McCarthy ⊜, chief chemist and metallurgist for Wickwire Spencer Steel Co. since 1919, died July 1. Mr. McCarthy was a past chairman of the Buffalo Chapter and served as secretary for many years. He has contributed to both *Metal Progress* and the A.S.M. *Transactions*, and was awarded the Wire Association Medal in 1935.

S. K. Colby

Safford Kinkead Colby, 74, vice-president in charge of research and advertising for Aluminum Co. of America, died suddenly of a heart attack on August 4. A pioneer of the aluminum business, he had been associated with the progress of his company for more than 51 years, from the time he joined the Pittsburgh Reduction Co. (which later became Aluminum Co. of America) in 1895.

In 1915 he was appointed assistant general sales manager for the company, and in 1920 was elected president of American Magnesium Corp. Mr. Colby came to Alcoa's general offices in Pittsburgh in 1928, and was placed in charge of the sales promotion and advertising divisions. He became a vice-president in 1931, and the supervision of the Aluminum Research Laboratories was added to his duties in 1937. He was a graduate of Rensselaer Polytechnic Institute with a civil engineering degree.

W. A. Ruhl

W. A. Ruhl ⊜, 48, works manager of the Universal Winding Co. of Providence, R. I., died early in September following an illness of several weeks. Mr. Ruhl received his B.S. and E.M. degrees from Michigan College in 1920 and 1921, and was employed by Nash Motors from 1921 until 1929. He then became production manager for the construction division of the Chain Belt Co., Milwaukee, and joined the Universal Winding Co. in 1933.

C. H. Bierbaum

Christopher H. Bierbaum ⊜, vice-president and consulting engineer in charge of research at the Lumen Bearing Co., died on June 16 at the age of 83. Mr. Bierbaum, who still spent some time each day at his office, joined the Lumen Co. in 1901. He was the inventor of the microcharacter, and originated and patented several phosphorus and nickel bearing bronzes.

D. H. Chason

Daniel H. Chason, ⊜ development engineer in the mechanical engineering department of the Singer Mfg. Co., died at his home in Elizabeth, N. J., of a heart ailment on June 30. Mr. Chason, who was 62, had been with the Singer Co. for 34 years.

DURASPU
23 FEET
of a
19 INCH
Centrifugally
CAST
"CARTRIDGE"
It's alloyed
meet a highly
rosive condition
It's centrifugally
cast to give it the
igher strength and
greater metal
ensity to meet a tough
actural requirement. It's
ypical of what we can do in
entrifugal casting department.
In this case two sections were made and welded together.
May we suggest that if you have need for any high alloy pipe or tube ranging in diameter from 2½ inches to 24 inches and, depending on diameter, up to 15 feet in length, you look into our centrifugal casting service.
THE DURALOY COMPANY
Office and Plant Scottdale Pa. • Eastern Office 30 East 42nd Street New York 17 N. Y.
Los Angeles & San Francisco
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20-516. Drill Jig for Pipe Manifold. *Machinery (London)*, v. 71, Aug. 21, 1947, p. 209.

Diagram and description.

20-517. Axelson Hollow-Spindle Lathe. *Engineering*, v. 164, Aug. 22, 1947, p. 187.

Machine tool made in Los Angeles.

20-518. More and Better Machines. George W. Hoehler. *Automotive Industries*, v. 97, Sept. 1, 1947, p. 72-74, 170, 174, 178, 181-182.

Recent advances in mass production equipment and techniques.

20-519. New Machine Tools and Production Equipment. *Automotive Industries*, v. 97, Sept. 1, 1947, p. 75-119, 186.

A large number of new machine tools and other items of production and plant equipment are described.

20-520. Latest Production Equipment to be Seen at the Show. *Machinery*, v. 54, Sept. 1947, p. 154-158, 161-166, 169-174, 177-182, 185-190, 193-198, 201-206, 209-214, 217-222, 225-232, 235-249.

Machine tools and other metalworking equipment shown at Machine Tool Show, Chicago, Sept. 17-26.

20-521. Metal Cutting Techniques. O. W. Boston. *Iron Age*, v. 160, Sept. 11, 1947, p. 185-189.

Today's cutting tools and techniques weighed against tomorrow's needs.

20-522. Milling Cutters. *Automobile Engineer*, v. 37, Aug. 1947, p. 302.

New design for negative rake use on machines of low horsepower.

20-523. Machine Tool Show in Print. *American Machinist*, v. 91, Sept. 11, 1947, p. 195-294.

Products shown at Chicago, Sept. 17-26.

20-524. Machine Tools. *Russian Technical Research News*, v. 1, Sept. 1947, p. 27.

Abstracts of three articles from *Stanki i Instrument:* A new method of knurling, by G. A. Tukhvatulin. Pneumatic chip remover, by A. L. Roginskii. Force of feed in high-speed friction saws, by N. I. Gorbatov.

20-525. Special Cutters—Precise Fashioners of Complicated Shapes. Jay DeEulis. *Steel*, v. 121, Sept. 15, 1947, p. 88-90, 126, 128, 130, 132, 135.

A number of special cutters, their applications, and processes used in making them.

20-526. Guards With a Grip. *Plastics (American)*, v. 7, Sept. 1947, p. 52-53.

Use of acrylic shields, with magnets to anchor them to ferrous surfaces, for protection from flying chips in metal machining operations.

20-527. Maintenance of Sintered Carbide Dies. *Industrial Diamond Review*, v. 7, Aug. 1947, p. 238-240.

Boring with diamond points; applications of coarse and medium size diamond powder on soft and hard sticks; use of diamond bonded wheels. (From 1946 Protolite Die Maintenance Manual, Protolite, Ltd., London.)

20-528. Hand Sharpening Machine for Formed Milling Cutters. *Industrial Diamond Review*, v. 7, Aug. 1947, p. 243.

A Swiss machine.

20-529. Automatic Internal Grinding Machine. *Industrial Diamond Review*, v. 7, Aug. 1947, p. 248-249.

A British machine tool.

20-530. New Designs at the 1947 Machine Tool Show. *Product Engineering*, v. 18, Sept. 1947, p. 81.

Materials of construction; electrical and electronic control circuits; hydraulic systems and pneumatic controls; power transmission elements.

20-531. Rotor Housings Speeded by Special Drill Press. *Tool Engineer*, v. 19, Sept. 1947, p. 47.

In 60 sec., the new drill press drills 30 holes simultaneously in the 22x24x 4¾-in. cast aluminum housing which covers the horizontal revolving cutting blade. The same operation required twice as much time with previous equipment.

20-532. Production Tooling With Carbides. Watson N. Nordquist. *Tool Engineer*, v. 19, Sept. 1947, p. 48-50.

New carbide tooling technique which increases metal cutting rates.

20-533. Cost Cutting With Production Grinders. Anders Jansson. *Tool Engineer*, v. 19, Sept. 1947, p. 51-52.

Several modern grinding machines.

20-534. Automatic Size Control of Cylinder Bores. Gunnar Skog. *Tool Engineer*, v. 19, Sept. 1947, p. 53.

Improved process called Hydrosizing holds cylinder bore to a consistent ±0.0005 in. This tool now materially reduces, if it does not entirely eliminate, the selective fitting of pistons in automotive cylinder bores.

20-535. New Developments in Tooling Obsolete Old Work Standards. *Production Engineering & Management*, v. 20, Sept. 1947, p. 90-98.

Innovations in tooling and procedures in Ford's engine division.

20-536. Hollow Tap Shanks Cut Tool Costs. *Iron Age*, v. 160, Sept. 18, 1947, p. 69.

Use of shanks produced from steel tubing with an internally broached spline. The new shanks are particularly useful in operations such as tapping pipe couplings where fairly long shank taps are used to tap through several parts at a time, allowing the parts to load up on the shank.

20-537. Locating Holes Accurately With a Precision Drilling Jig. Robert Mawson. *Steel*, v. 121, Sept. 22, 1947, p. 86.

Description and diagrams show proper technique.

20-538. Development of a Special Drill for Plexiglas Fabrication. Beckh. *Headquarters Air Materiel Command, Wright Field, Dayton, Ohio (Translation F-TS-911-RE)*, July 1947, 38 p.

Tests with a new type of spiral drill bit, made of toolsteel with a more acute twist angle, polished chip duct and double cutting edge. This drill costs approximately 10% more than a standard spiral drill, but effects a time saving of 30 to 40% during machining. It can be manufactured on a standard-production automatic screw machine. (From publication of W. Kopperschmidt and Soehne, Hamburg, Germany, May 1942.)

For additional annotations indexed in other sections, see:
4-126; **24**-258-266-271; **27**-174-175-178-180-189-204-210.

539 brief digests covering all published developments in this field during 1946 appear in Vol. 3, ASM Review of Metal Literature. Vols. 1, 2 and 3 together give you three-year index to the metal industry. Each Vol. $10.00 to ASM Members. $15.00 to Nonmembers. American Society for Metals, 7301 Euclid Ave., Cleveland 3.

21 LUBRICATION and Friction; Bearings

21-77. Les Coussinets En Aluminium. (Aluminum Bearings.) Michel Goret. *Revue de l'Aluminium*, v. 24, no. 133, May 1947, p. 155-169.

A history of the use of aluminum alloys for bearings stressing past French work. Recent tests on bearings made of three French and two American alloys; properties and applications.

21-78. The Frictional Properties of Some Lubricated Bearing Metals. P. G. Forrester. *Journal of the Institute of Metals*, v. 73, June 1947, p. 573-589.

Study of the kinetic friction of four different bearing alloys against lubricated steel at low sliding velocities. The friction observed for any particular alloy depends on sliding velocity, temperature, and the surface finish of the steel, though the effects of these factors are not independent. The chief differences between the four alloys are in the extent of fluid friction present under a given set of conditions. Tin and lead-base babbitts promote fluid friction to a much greater extent than copper-lead alloys, while cadmium-nickel has, in general, intermediate properties. 26 ref.

21-79. Scoring and Burnishing in Bearings. V. H. Brix. *Aircraft Engineering*, v. 19, July 1947, p. 218-221.

Investigations into these two phenomena associated with the lubrication problem.

21-80. Surface Activity of Lubricant. J. M. Wilson. *Iron and Steel Engineer*, v. 24, Aug. 1947, p. 46-49; discussion, p. 50-54.

The phenomena of surface activity may provide the answers which will explain lubricant behavior. Relation to some of the performance aspects of lubricants. Behavior of lubricants and their suitability for various applications.

21-81. Structural Viscosity as the Cause of Lubricating Properties. H. Umstatter. *Engineers' Digest (American Edition)*, v. 4, June 1947, p. 264-267.

The theory of structural viscosity. The hydrodynamic theory of bearing friction, which regards viscosity as dependent only on temperature and pressure, does not fully account for the experimental facts. Structural viscosity results from the effects of viscosity as well, and is a common property of all liquids. A structural viscometer is used in the plotting of yield curves of lubricants. (Translated and condensed from *Die Technik*, v. 1, July 1946, p. 46-52.)

21-82. Babbitt Alloys for Plain Bearings. P. G. Forrester. *Engineering*, v. 164, Aug. 22, 1947, p. 184-185.

The fundamental requirements of a bearing alloy. Babbitt and similar alloys have considerable advantages from a frictional point of view. The factors upon which optimum performance depends. 17 ref. (To be continued.)

21-83. A Molecular Theory of Friction. V. S. Shchedrov. *Journal of Technical Physics (U.S.S.R.)*, v. 17, no. 5, 1947, p. 537-542. (In Russian.)

A mathematical analysis of forces involved in friction between two surfaces, for conditions in which the areas of contact between the microprojections of the two contacting surfaces may be considered as circular.

21-84. Lubricating Wire Rope. J. A. Rigby. *Steel*, v. 121, Sept. 8, 1947, p. 88, 91.

Recommendations for choice and use of lubricants.

21-85. Machine Tool Lubrication From the User's Point of View. W. H. McKaig. *Lubrication Engineering*, v. 5, Aug-Sept. 1947, p. 43-44.

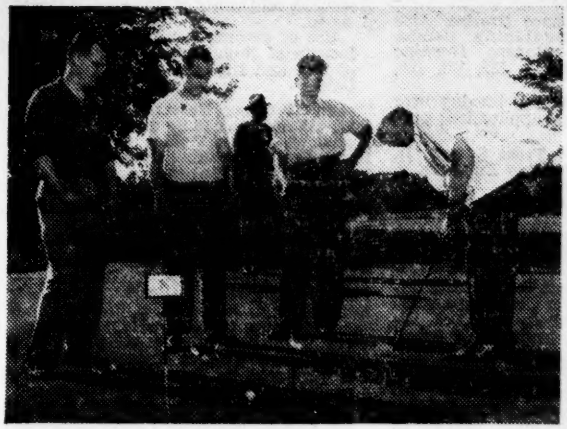
Recommended procedures for minimizing wear of machine tools.

For additional annotations indexed in other sections, see:
3-279; **27**-205.

112 brief digests covering all published developments in this field during 1946 appear in Vol. 3, ASM Review of Metal Literature. Vols. 1, 2 and 3 together give you three-year index to the metal industry. Each Vol. $10.00 to ASM Members. $15.00 to Nonmembers. American Society for Metals, 7301 Euclid Ave., Cleveland 3.

(Turn to page 38)

Western Ontario Has First Annual Field Day



Sweating It Out on the Putting Green at the First Annual Field Day of the Western Ontario Chapter Are (Left to Right) Bruce Barron of Alloy Metal Sales; Len Atkins, Quality Steel Co.: Bill Lyon, Kelvinator of Canada; and Hugh Watson, Alloy Metal Sales. Settling a Good-Natured Argument on the Horseshoe Pitch Are Clarence V. Monture, Monture and Sons Plumbing and Heating; C. George Dutton, Du-Vis Products; Tommy Carson, Carson's Machine Shop; and Barry Blay, Kelco Engineering of London, Ont.

Oil Well Drilling Equipment Discussed By 3-Man Panel

Reported by H. L. Millar

Assistant Metallurgist, Plomb Tool Co.

With California ranking as one of the world's greatest oil-producing regions, "Oil Well Drilling Equipment" was an appropriate subject for a round-table discussion which formed part of the spring educational series of the Los Angeles Chapter. S. W. Webster, Emsco Derrick and Equipment Co.; H. C. Smith, H. C. Smith Oil Tool Co.; and R. L. Engstrom, Hydril Corp., were the speakers.

Mr. Webster opened the discussion by describing the conversion from wooden derricks to steel. Today, with wells to 16,000 ft. and plans being formulated to carry them down to 20,000, derricks of 900,000 lb. capacity are being erected 176 ft. high on bases 40 ft. square. Drilling machinery on the derrick floor was described briefly.

Herschel Smith, second speaker of the evening, compared the long, arduous task of drilling with the fishtail bit to the relatively rapid operation of a rotary job. The oil drilling industry, the speaker related, was first to pioneer in the use of hard facing metals.

The third subject, "The Drilling String", was discussed by Mr. Engstrom, who reviewed the mechanical properties of the different grades of drill pipe (C, D, E, M-80, and alloy) and related that the A.P.I. size-limiting specification for drill pipe has materially reduced the factor of safety in deep drilling even when using alloy pipe of 150,000 psi. tensile strength. For example, a 3½-in. string working at 18,000 ft. operates at a safety factor of only 1.24.

The problem of tool joint strength and abrasion resistance has been partially solved by the use of 4140 steel with a welded-on tungsten carbide wear ring, but as wells are carried to greater depths, Mr. Engstrom concluded, new problems will present a never-ending challenge to the ingenuity of the engineering and metallurgical professions.

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22 WELDING
Flame Cutting; Riveting

22-438. All-Welded Ship Repairs. *Welding*, v. 15, July 1947, p. 330-331.
Repairs recently made on American ship.

22-439. Progress in Research. *Welding*, v. 15, July 1947, p. 334-336.
A survey of recent welding investigations.

22-440. Bonding Rubber to Metal With Ty-Ply. Robert Shattuck. *Rubber Age*, v. 61, July 1947, p. 451-454.
Use of this adhesive composition; test data on bond characteristics.

22-441. Les Scellements Ceramique Metal. (Ceramic-Metal Seals.) M. Kuhner. *Le Vide—Technique-Applications*, v. 2, Jan. 1947, p. 194-204.
Advantages of using ceramic material instead of glass in the construction of high-frequency tubes. The direct brazing of ceramic-metal seals.

22-442. Mechanized Oxy-Acetylene Soft Soldering. *Sheet Metal Worker*, v. 38, July 1947, p. 51-52.
(Reprinted from *Linde Tips.*)

22-443. Soldering Paste "Mosenergo". *Industrial Power (U.S.S.R.)*, no. 3, 1947, p. 14-15. (In Russian.)
A newly developed paste for use in joining copper, lead, and other metals, specifically in electrical installations. The composition is: resin, 10 parts; animal fat, 5 parts; ammonium chloride, 2 parts; zinc chloride, 1 part; and water, 1 part.

22-444. Stresses in Welded Structures. A. Nikolaev and N. N. Proklorov. *Bulletin of the Academy of Sciences of U.S.S.R. (Section of Technical Sciences)*, no. 3, 1947, p. 307-318. (In Russian.)
By means of a deflectometer, the deformation of welded specimens was measured as a function of time and temperature of base metal during welding. A relationship was established between the dimensions of the weld specimen, the alloying effects of nickel, and the magnitude of residual stresses. It was found that residual stresses in the weld are appreciably lowered by cooling the seam with water at the time the bead is being deposited.

22-445. British Shipbuilding. Part I. Vickers-Armstrongs' Naval Construction Works. L. Redshaw. *Welding*, v. 15, July 1947, p. 294-306.
The economic requirements for introduction of welding into a shipyard building passenger liners where repetition of a particular design is unusual.

22-446. Resistance Welding in Mass Production; Projection Welding Machines. A. J. Hipperson and T. Watson. *Welding*, v. 15, July 1947, p. 307-313.
Fundamental principles. Examples of the latest types of equipment and their particular application. The most recent multi-station indexing types of machine.

22-447. Structural Alterations; Arc Welding Solves Workshop Problem. E. E. Wright. *Welding*, v. 15, July 1947, p. 314-316.
How important structural alterations to a workshop were carried out by arc welding.

22-448. Boiler Repairs. J. K. Johannesen. *Welding*, v. 15, July 1947, p. 323-325.
Examples of welding maintenance work.

22-449. Oxygen Cutting. Part XII. E. Seymour Semper. *Welding*, v. 15, July 1947, p. 326-329.
Manual methods of cutting cast iron and stainless steel.

22-450. Methods for Maintaining Positions and Dimensions of Parts During Brazing. *Product Engineering*, v. 18, Aug. 1947, p. 120-121.
Welding and assembly techniques, permanent and temporary methods of support, and instances of poor practice.

22-451. Electric Furnace Brazing Aids Manufacture of Insecticide Bombs. Harold J. Mallia. *Modern Machine Shop*, v. 20, Aug. 1947, p. 132, 134, 136, 138.
Advantages of furnace brazing over local heating for this application; procedure.

22-452. Prefabricated Truss Spans. H. Bowden Fletcher. *Welding Engineer*, v. 32, Aug. 1947, p. 33-37.
Prefabrication procedures for two 440-ft. truss spans.

22-453. Batting Out Bug Bombs. Athel F. Denham. *Welding Engineer*, v. 32, Aug. 1947, p. 38-39.
How special six-station fixtures index automatically for the rapid assembly of one-shot, one-room, D.D.T. insecticidal bombs by projection welding.

22-454. Welded Lighting Installation. Alfred A. Wald. *Welding Engineer*, v. 32, Aug. 1947, p. 40-42.
Construction of welded channels for conductors for fluorescent lighting in the drafting department of Caterpillar Tractor Co.

22-455. Metal Cutting With the Metal Arc. T. B. Jefferson. *Welding Engineer*, v. 32, Aug. 1947, p. 45-47.
Procedures and applications of the Arcos "Oxyarc" process in which a stream of oxygen is directed into a pool of molten metal which is made and kept molten by an arc between the base metal and the coated tubular rod. Current settings and oxygen pressures for different metals.

22-456. Glycerine and Welding. Georgia Leffingwell and Milton A. Lesser. *Welding Engineer*, v. 32, Aug. 1947, p. 52, 54-55.
Uses of glycerine and its compounds in welding include spatter preventives, ultraviolet protective paint, fire resistant fabrics, welding curtains, antifogging compounds, and bonding agents for abrasives. 22 ref.

22-457. Transformers for Submerged-Melt Welding. R. F. Wyer. *Welding Engineer*, v. 32, Aug. 1947, p. 56-58.
How to select the proper sizes of welding transformers for a submerged-melt welding installation. Practical information on selection of control equipment.

22-458. A Study of Furnace Brazing as Applied to 12% Chromium Low-Carbon Steel. T. H. Gray. *Transactions of American Society for Metals*, v. 39, 1947, p. 453-478; discussion, p. 478-487.
Tensile and rupture tests on copper-brazed specimens of 12% chromium steel prepared in different manners. Strong, sound brazed joints are produced between impulse blades of a steam turbine operating at a steam temperature of 930° F. and pressure of 1250 psi. Effects of varying the smoothness of adjoining surfaces, method of feeding, spacing of joints, degree of oxidation, and composition of the brazing alloys were studied. High-purity gases possessing dew points of minus 35° C. or better are required to successfully braze high-chromium steels. The use of dissociated ammonia as a protective atmosphere.

22-459. Pressure Welding of Stainless Steel. Arnold L. Rustay. *Metal Progress*, v. 52, Aug. 1947, p. 238-242.
Pressure welding or solid phase welding is the fundamental process involved in powder metallurgy; in this article, however, the meaning is restricted to the welding of bars, tubes or other commercial shapes into mechanical parts by heating the joint with a gas flame and pressing the parts together.

22-460. Large Herringbone Gear Fabricated by Welding. *Iron Age*, v. 160, Aug. 7, 1947, p. 83.
Fabrication of unusually large steel gears.

22-461. Shop Shots at Day and Night. *American Machinist*, v. 91, Aug. 14, 1947, p. 94-95.
Use of automatic welding in manufacture of 20-gal. water-heater boilers at Day and Night Mfg. Co., Monrovia, Calif.

22-462. Welding Research Strength of Spot Welds in M.S. Sheet; Welded Stanchion Joints; Welded Constructions Under Fatigue Loading Conditions; Heat Treatment of Welded Constructions. *Transactions of the Institute of Welding B.W.R.A. Supplement*, v. 10, June 1947, p. 2, 5.
A résumé of four recent reports.

22-463. New Full and Semi-Automatic Welding Machines. P. Sevibo and V. Paton. *Engineers' Digest (American Edition)*, v. 4, July 1947, p. 315-322.
Three new types of welding machinery developed in the U.S.S.R. The "Combined Welding Automat UWA-2" is produced in two forms—for self-propulsion along a track, or stationary. The "Welding Tractor TS-6" is used for welding continuous longitudinal or circumferential welds of work too large for bed-type machines. The "Welding Semi-Automat TS-8" is still in the experimental stage. (Translated and condensed from a publication of the Institute of Electro-Welding, Ukrainian Academy of Sciences, U.S.S.R. 32 pages. 1946.)

22-464. Some Effects of Welding Heating Cycles on Heat and Corrosion Resisting Steels. H. Bull. *Metallurgia*, v. 36, July 1947, p. 137-144.
The three main types of steels used, and some effects of the welding heat on material adjacent to the weld. Changes in structure, corrosion resistance, and mechanical properties; metallurgical steps taken to overcome them.

22-465. Effect of Variables in Welding Technique on the Strength of Direct-Current Metal-Arc Welded Joints in Aircraft Steel. Part I. Static Tension and Bending Fatigue Tests of Joints in S.A.E. 4130 Steel Sheet. C. B. Voldrich and E. T. Armstrong. *National Advisory Committee for Aeronautics Technical Note No. 1261*, July 1947, 52 p.
Arc welded butt joints in ⅛-in. S.A.E. 4130 steel sheet, which were made under various conditions of welding and heat treatment, were tested to evaluate the effects of specific welding-technique factors on the strength of the joints.

22-466. Welding Steel Trailer Door Frames Increases Strength, Saves Weight. Athel F. Denham. *Materials & Methods*, v. 26, Aug. 1947, p. 93-96.
The development of three universal-type automatic spot welding machines to assemble the basic framework of the door frames supplemented by a turntable-type fixture at which various brackets are attached with portable welding guns.

22-467. Light Material—Heavy Production. Joseph Weindl. *Industry and Welding*, v. 20, Aug. 1947, p. 26-29, 46.
Forming and fabrication of miscellaneous sheet metal products by Western Metal Specialty Co., Milwaukee. Emphasis on resistance welding.

22-468. When and How to Mechanize Hard Facing Operations. Eldon Hurt. *Industry and Welding*, v. 20, Aug. 1947, p. 30-32, 44, 46.
Important factors in mechanizing hard facing operations. (To be continued.)

22-469. The Art of Ornamental Iron Welding. *Industry and Welding*, v. 20, Aug. 1947, p. 40-42, 76-79.
Some techniques used by Florida Mfg. and Welding Co.

22-470. Welded Pipe Fabrication. The Multi-Piece Welded Turn. Arthur R.

(Turn to page 40)

Details Varied Uses Of Platinum Metals

Reported by George L. Barnard
Metallurgist
Los Alamos Scientific Laboratory

The platinum metals and their uses were discussed by E. M. Wise of the International Nickel Co., before the Los Alamos Chapter ⚙, in the first lecture of the 1947-48 season. Steps in the production, concentration and refining of the complex ore from the Canadian mines, which yield nickel, copper, and the platinum-group metals, were illustrated with a sound movie.

Mr. Wise traced the history of platinum from the time of its discovery in South America, and told how processing methods developed from the powder metallurgy work of Wollaston, melting on lime refractories by Deville and Debray, to high frequency melting.

The major technologic applications of this group of six metals include the use of palladium, platinum and rhodium for electrical contacts, platinum for aircraft spark plugs and for resistance thermometers and thermocouples. Chemical uses include the rhodium-platinum ammonium oxidation catalyst, universally employed for producing nitric acid; platinum and palladium hydrogenation catalysts for organic products, including vitamins; spinnerets for rayon and equipment for producing fiber glass, synthetic salt crystals and insulating for incandescent lamps. Platinum is also used for safety disks in chemical equipment, and clad materials for reaction vessels and insoluble anodes. Some of the age hardening alloys containing palladium and platinum are employed in dentistry, and another well-known use is palladium and platinum for fine jewelry.

The wide range of properties obtainable with this group of metals and the diversity of their uses make them very interesting. As a closure a film showing the methods of producing wrought nickel alloys was presented.

Corrosion as Well as Friction Is Important Factor in Lubrication

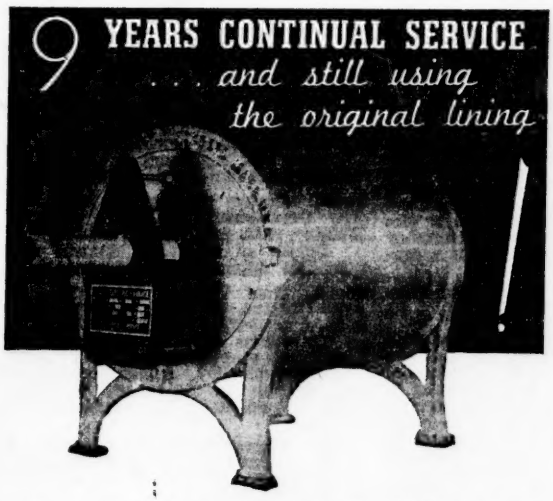
Reported by A. W. Crossley
Trans-Canada Air Lines

With motion pictures followed by discussion, B. H. Miller of the Imperial Oil Co., Ltd., described "Trends in Lubrication" before the Manitoba Chapter ⚙. The motion picture "Inside Story" illustrated in detail the theories of lubrication and application of these theories to the selection of proper types of lubricants for bearings, gears, and cylinders operating under various conditions of speed, load and temperature.

Most wear of machine parts is caused by corrosion and not by friction, Mr. Miller pointed out. Shutdown periods allow metal oxides to form on stationary parts and practice has shown that wear is greater on machines operated intermittently than on those operated continuously. Thus a lubricant should be chosen not only for its antifriction properties but also for corrosion resistance. Other uses for lubricants are as a coolant, heat transfer medium, vapor seal, scavenger of products of combustion and for the transmission of power.

The new refining developments which allow for the inclusion of inhibitors and additives in lubricants were discussed. The main use of an inhibitor in an oil is to improve its antioxidation properties and thereby improve its ability to protect metallic surfaces. Additives are many in number and may act as a dispersal agent for impurities to prevent sedimentation, as a means of improving film strength under pressure, as a pore depressor to lower pore temperature, or as a viscosity index improver or to improve tackiness.

Inhibitors and additives must be selected carefully so that one agent does not neutralize the effect of another for any particular job. A lubrication system must be thoroughly cleaned out before changing over to a lubricant containing different refinery inclusions in the oil.



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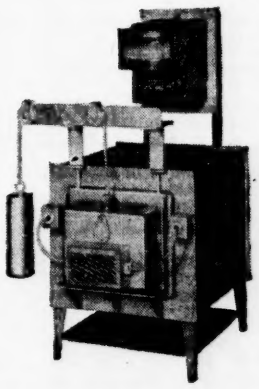

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Berry. *Industry and Welding*, v. 20, Aug. 1947, p. 48, 50, 52.

Various methods for closing the end of a pipe line.

22-471. Torch Brazing Aluminum. Part II. Harry A. Huff. *Western Machinery and Steel World*, v. 38, Aug. 1947, p. 80-84.

Joint design; jigs, fixtures, and positioners; four major steps in torch brazing of aluminum, namely, prebrazing cleaning, fluxing, flowing the filler metal, and post-brazing cleaning.

22-472. Coordinated Development of A.C. Welders and Electrodes. C. P. Croco. *Western Machinery and Steel World*, v. 38, Aug. 1947, p. 92-95.

Absence of arc blow, lower power consumption, and lower maintenance costs are three advantages a.c. welding has over d.c. Advances made to coordinate a.c. welders and suitable electrodes.

22-473. A Useful Approach to Resistance Welding. B. G. Higgins. *Sheet Metal Industries*, v. 24, Aug. 1947, p. 1639-1642.

Spot welding is the most widely used of the resistance welding processes. The advent of electronic control opened up new possibilities in resistance welding through its ability to give precise and accurate timing of the welding current. (To be continued.)

22-474. The Welding of Copper and Its Alloys. Part VIII. E. G. West. *Sheet Metal Industries*, v. 24, Aug. 1947, p. 1643-1645.

Arc welding of copper-aluminum alloys, carbon-arc welding and resistance welding.

22-475. Discussion of Technical Papers on the Spot Welding of Light Alloys, Presented at the Third Session of the British Welding Research Association; Symposium on the Welding of Light Alloys. *Sheet Metal Industries*, v. 24, Aug. 1947, p. 1650-1654, 1656.

Uses, advantages, strength, and effectiveness of spot welding of light alloys.

22-476. A.C. Welding Development. C. P. Croco. *Western Metals*, v. 5, Aug. 1947, p. 34-36.

A review of early experiments, recent advances, and advantages of a.c. over d.c. welding.

22-477. Practical and Economical Aspects of Furnace Brazing Processes. Part II. C. L. West. *Steel Processing*, v. 33, Aug. 1947, p. 492, 498.

Strength of brazed joints; carburizing brazed assemblies and the prevention of decarburization; temperature conditions in regard to brazing applications; furnaces.

22-478. Radiographic Weld Control for Pipe Line Construction. Walter W. Offner. *World Oil*, v. 126, Aug. 18, 1947, p. 114, 118, 121.

Some highlights and economic advantages of this process.

22-479. Inert-Arc Welding With Direct Current. R. F. Wyer. *Iron Age*, v. 160, Aug. 21, 1947, p. 68-70.

Methods of applying this technique to stainless steel, copper, aluminum, and magnesium. Recommended amperage and welding speed; helium consumption; electrode size; type of gas; welding generator; electrode holder and electrode.

22-480. Arc Welding Is Being Handicapped. James F. Lincoln. *Scientific American*, v. 177, Sept. 1947, p. 101-105.

Limitations and restrictive tests placed upon arc welded joints, but not on similar joints designed for similar purposes and completed by riveting.

22-481. Silver Plating Facilitates Bonding Glass to Steel. Norman S. Freedman. *Steel*, v. 121, Aug. 25, 1947, p. 92, 94.

Study of adherence of silver to steel shows that bond is improved when diffusion of silver into iron and iron into silver takes place by heating.

22-482. Specification Changes. R. H. Davies. *Steel*, v. 121, Aug. 25, 1947, p. 96, 101, 120.

The adoption of arc welding in the fabrication of fire trucks reduces the amount of tooling required to make specification changes.

22-483. In Welding Stainless Steel Containers Distortion Can Be Controlled. L. K. Stringham. *Sheet Metal Worker*, v. 38, Aug. 1947, p. 51-52.

A procedure table.

22-484. Metallic Joining of Light Alloys. *Light Metals*, v. 10, Aug. 1947, p. 421-424. (Continued.)

Gas welding of aluminum alloys. The need for removing all flux residues after completion of the work. (To be continued.)

22-485. Correct Technique Necessary for Stainless Welding. L. K. Stringham. *Iron Age*, v. 160, Aug. 28, 1947, p. 61-63.

Practices to be followed, the electrodes to be used, and the preheat and postheat temperatures for each main type of stainless steel to obtain maximum corrosion resistance and structural strength.

22-486. Arc Welding in Making Aluminum Doors. M. N. Vuchnich. *Light Metal Age*, v. 5, Aug. 1947, p. 10.

The welding of the framework of aluminum overhead industrial doors consists of butt welding the flanges and intermittently fillet welding the webs, the mating components being coped to provide a finished flush surface on both the inside and the outside. Small triangular gussets are butt welded into position wherever they are required for the support of standard steel strap hinges.

22-487. Improved Products by Mechanized Welding and Cutting. Earl Griffeth. *Welding Journal*, v. 26, Aug. 1947, p. 670-674.

Use of mechanized welding and cutting in the manufacture of a complete line of heavy-duty earth-moving equipment.

22-488. Coordinated Development of A.C. Welders and Electrodes. C. P. Croco. *Welding Journal*, v. 26, Aug. 1947, p. 680-683.

Absence of arc blow, lower power consumption and lower maintenance costs are three advantages a.c. welding has over d.c. welding. The absence of arc blow when using high currents, and when welding in corners, is a characteristic that for some time has been recognized as a major advantage of a.c. welding. The efficiency of a transformer compared to a motor-generator set.

22-489. The Electric Welding of Pipe. Omer Blodgett. *Welding Journal*, v. 26, Aug. 1947, p. 684-689.

Prefabrication of piping is used with great success in shipbuilding and can be utilized equally well in industrial and home piping. More welding is possible for industry and home service than for shipbuilding because many valves, strainers, and other parts in ships must be connected by flanges so that they can be taken off at regular intervals for cleaning and inspection. Piping in a diesel-driven, ocean-going ship.

22-490. S-Curves Point the Way for Successful Welding of Any High-Carbon or Alloy Steel. Leo Berner. *Welding Journal*, v. 26, Aug. 1947; discussion, p. 689-692.

Critical comments on paper appearing in Feb. 1947 issue with author's reply.

22-491. Work Supports for Machine Cutting. J. A. Arnault. *Welding Journal*, v. 26, Aug. 1947, p. 696-697.

Supports for oxy-acetylene shape cutting must meet two basic requirements—they must be level and steady and they must hold the work in a manner that will not interfere with clear passage of the cutting oxygen stream through the material being cut.

22-492. Vital Parts for Coal Loader Unit Are Fabricated by Automatic Welding Arc. C. W. Lytton. *Welding Journal*, v. 26, Aug. 1947, p. 698-699.

Fabrication of the gathering head assembly for a coal loader. By applying the current process of automatic metallic arc welding, daily production of these vital parts was doubled, positive accuracy of alignment of the various members was obtained and the labor cost per piece was materially reduced.

22-493. Observations of Electrode Tip Pickup and Tip Life in the Spot Welding of Magnesium Alloy Sheet. W. F. Hess, T. B. Cameron, and R. A. Wyant. *Welding Journal*, v. 26, Aug. 1947, p. 433s-442s, 484s.

Methods for evaluating the useful life of an electrode tip when spot welding magnesium sheet; the comparative tendencies for sheet of different compositions and tempers to cause pickup; the influence of preweld cleaning method, surface resistance and weld size on tip life; the importance of welding current direction; the effect of pickup on the production of sound welds.

22-494. Transverse Shrinkage of Welds. F. Campus. *Welding Journal*, v. 26, Aug. 1947, p. 485s-488s.

Numerical data for several types of butt and fillet welds made under a variety of conditions.

22-495. Production Jobs for Inert-Gas Shielded-Arc Welding. H. T. Herbst. *Steel*, v. 121, Sept. 1, 1947, p. 72-74, 92, 94, 96.

New process uses argon or helium sheath to protect electrode and weld puddle in welding stainless, high-carbon and alloy steels, aluminum, brass, Inconel, monel, everdur, and pure silver.

22-496. Increasing the Durability of Rotor Blades of Boiler Exhaust Fans. B. M. Kontorov and I. I. Rafalvich. *Industrial Power (U.S.S.R.)*, v. 4, July 1947, p. 10-11. (In Russian.)

Superior welding-rod compositions for fabrication of rotor blades. Stalinite—a Cr-Mo-V alloy—was good, but was in short supply. Three other alloys were developed and tested. The most satisfactory contained 5% boron carbide and was found to be 2 to 2½ times more durable than Stalinite.

22-497. Oxyarc Cutting; an Important New Development. R. N. Thompson. *Welding*, v. 15, Aug. 1947, p. 344-349.

Details of special equipment and possible applications; operating data.

22-498. Spot Welding Steel With an Alloy Content. C. A. Kershaw. *Welding*, v. 15, Aug. 1947, p. 350-355.

Difficulties encountered when spot welding steels containing small amounts of alloy. A metallurgical investigation into the causes. Postheating was adopted with satisfactory results.

22-499. Choose the Right Electrode; a Guide to Properties and Applications. W. D. Waller. *Welding*, v. 15, Aug. 1947, p. 356-365.

Disadvantages of the various British and American standard specifications and classifications. The various types of mild and low-alloy steel electrodes and their special characteristics and uses. (To be continued.)

22-500. Resistance Welding in Mass Production; Projection Welding Electrodes. A. J. Hipperson and T. Watson. *Welding*, v. 15, Aug. 1947, p. 366-374.

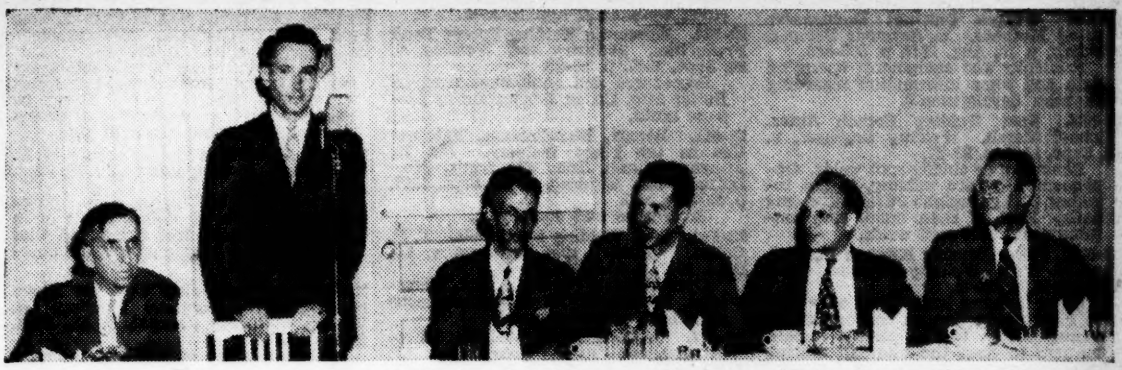
Design, arrangement, and maintenance of electrodes.

22-501. Electro-Physics of the Welding Arc; Trends of Recent Research. L. H. Orton. *Welding*, v. 15, Aug. 1947, p. 375-379.

Based in part on a paper presented

(Turn to page 42)

"Stars" Seen and Heard at Worcester



At the Speakers' Table for the Sept. 10 Meeting of the Worcester Chapter Are, Left to Right: Robert Chadwick, Member of the Executive Committee and Chairman of the Entertainment Committee; Albert Linnell of the Harvard Undergraduate School, Who Spoke on "The Romance of Our Galaxy"; Lloyd G. Field, Chapter Chairman; Hilding Edberg, Secretary-Treasurer; Leo P. Tarasov, Vice-Chairman; and Walter Gulliksen of the Executive Committee

Fundamentals of Physics Explained for Metallurgists

Under the title "Physics You Should Know", the educational course of the Milwaukee Chapter this year is devoted to those fundamentals of physics which form the basis of our present-day physical metallurgy. The course consists of five lectures starting Monday, Nov. 3. The program is as follows:

Nov. 3—Structure of Metals, by J. T. Wilson, physicist, Allis-Chalmers Mfg. Co.

Nov. 10—Mechanics and the Strength of Materials, by R. E. Boeck, associate professor of civil engineering, Marquette University.

Nov. 17—Wave Motion: Light, Heat, Sound, by A. G. Barkow, associate professor of physics, Marquette University.

Nov. 24—Electricity. I—Direct Currents, by T. B. Jochem, supervising development engineer, Cutler-Hammer, Inc.

Dec. 1—Electricity. II—Alternating Currents, Electronics, by E. J. Rathsack, engineer in charge, electronic devices section, Allis-Chalmers Mfg. Co.

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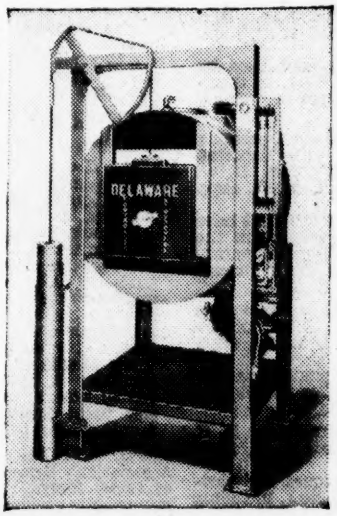

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at a symposium held by the British Welding Research Association in 1945. 41 ref.

22-502. Oxygen Cutting; Underwater Cutting Methods. E. Seymour Semper. *Welding*, v. 15, Aug. 1947, p. 380-385.

Principles and equipment; operating data and some information regarding German developments.

22-503. Spot Welding French Autos. Michael Marsh. *Welding Engineer*, v. 32, Sept. 1947, p. 33-37.

Renault uses chiefly spot welds, supplemented by arc welding, to put together 80 lightweight Juvaquatre cars daily. Each of these small cars contains about 4750 spot welds.

22-504. Silver Brazing Kitchen Faucets. Fred M. Burt. *Welding Engineer*, v. 32, Sept. 1947, p. 42-45.

Silver brazing lends itself very well to mass production on continuous assembly lines. Use of gas-air radiant burners to heat the alloy to brazing temperature.

22-505. Education for Welding Personnel. Part I. Walter J. Brooking. *Welding Engineer*, v. 32, Sept. 1947, p. 51-53.

LeTourneau Technical Institute's highly effective plan for the training of welding engineers and production specialists combines classroom instruction, on the college level, with paid part-time employment.

22-506. Flux-Injection Cutting. Part I. G. E. Bellew. *Welding Engineer*, v. 32, Sept. 1947, p. 60, 62-63, 74, 76.

Process makes possible flame cutting of stainless steels on a production basis by injecting powdered flux via the cutting-oxygen stream.

22-507. Flames for Welding. T. Courard. *Engineers' Digest (American Edition)*, v. 4, Aug. 1947, p. 370-374.

The comparative thermodynamic qualities of the flames utilized in gas welding and their influence on different metals. Although the results of this study are of a highly theoretical character because they are based on the assumption that physico-chemical equilibrium is reached, they are of great interest to the practical welder because they show the general tendency of actual phenomena. (Translated and condensed from *Revue de la Soudure*, no. 1, 1945, p. 22-33.)

22-508. Electric Resistance Welded Steel Tubing. E. W. Allardt. *Iron and Steel Engineer*, v. 24, Aug. 1947, p. 55-64; discussion, p. 64-66.

Operations in the making of welded steel tubing; its advantages and uses.

22-509. Low Temperature Silver Alloy Brazing. *Steel*, v. 121, Sept. 8, 1947, p. 76-77, 108, 110.

Several production techniques, in some cases realizing savings as high as 50%.

22-510. Welding With Superimposed High Frequency Current by Means of the Polytrode. *Engineering Materials and Processes*, v. 5, Aug. 1947, p. 83-84.

Several advantages for the Polytrode, in which a spark gap high-frequency generator is used to provide high-frequency power.

22-511. Applications of Flux-Injection Cutting to Stainless Steel. G. E. Bellew. *Canadian Metals & Metallurgical Industries*, v. 10, Aug. 1947, p. 16-19.

Selection of a fluxing agent and the equipment for applying this flux. Comparison of flux-injection cutting with normal oxy-acetylene cutting techniques. The principal current uses. Quality of cut obtained and the effect of the cutting action on various types of stainless steel.

22-512. Hydraulic Pressure Provides Uniform Welds. *Steel*, v. 121, Sept. 15, 1947, p. 104.

New welding gun eliminates destructive burning and pitting at the point of the weld in spot welding. Uniform hydraulic pressure is applied to the points.

22-513. How Pressure Welding Works. *Engineering and Mining Journal*, v. 148, Sept. 1947, p. 77.

Steps in the process; operating principle; equipment; applications.

22-514. Automatic Welding Speeds Tank Production. *Industry and Welding*, v. 20, Sept. 1947, p. 26-29.

Procedures and equipment used by Butler Mfg. Co. in fabrication of propane tanks.

22-515. Repair, Maintenance, Fabrication in the Plant Welding. No. 12. Anheuser-Busch, Inc., St. Louis, Mo. *Industry and Welding*, v. 20, Sept. 1947, p. 30-32, 47-48.

Procedures and equipment.

22-516. Spot Welding Specialists. T. P. Cullin. *Industry and Welding*, v. 20, Sept. 1947, p. 34-35, 38, 64-65.

Operations of Spotweld, Inc., Cleveland, in production of miscellaneous aluminum consumer goods.

22-517. Technique for Welding 11 to 14% Manganese Steel. Robert Bramley. *Industry and Welding*, v. 20, Sept. 1947, p. 40-42, 44.

Weaving; short, heavy beads; peening. A detailed procedure for rebuilding dipper teeth.

22-518. This Welder Has Multiple Take-Off. J. C. Albright. *Power*, v. 91, Aug. 1947, p. 108.

Arrangement for oxy-acetylene welding outfit which permits use of more than one welding or cutting tip at the same time with only one set of regulators and gas cylinders.

22-519. Positioner Holds Parts in Easy Welding. A. J. Beldon. *Power*, v. 91, Aug. 1947, p. 109.

Versatile welding jig made of angle iron.

22-520. Manual of Terminology and Abbreviations: Bolts, Nuts, Screws, Rivets, and Related Fasteners Products. *Fasteners*, v. 4, no. 2, 1947, p. 11-14.

22-521. Sems. Walter M. Hanneman. *Fasteners*, v. 4, no. 2, 1947, p. 4-7.

A screw, when combined with a washer into one unit, is called a sem. Numerous types and applications.

22-522. Threading of High-Temperature Bolt Studs. K. D. Williams. *Fasteners*, v. 4, no. 2, 1947, p. 8-10.

Results of load-deformation tests for several bolt and nut combinations (¾-in., 10 threads per in., with 3, 4, 5, and 6 threads engaged).

22-523. Welded Steel Furniture. Dan Raffone. *Welding Journal*, v. 26, Sept. 1947, p. 761-766.

Procedures and equipment used by Simmons Co., Kenosha, Wis., in fabrication using various types of welding and brazing.

22-524. How to Select Good Operating Current Levels for Use With Tungsten Electrodes in Inert-Arc Welding. R. W. Tuthill. *Welding Journal*, v. 26, Sept. 1947, p. 766.

Chart shows current levels that have been used for manual welding in the General Electric welding laboratory for several years, and gives current levels for each electrode size.

22-525. Arc Welding Used in Renovation of Railroad Equipment. A. L. Champigny. *Welding Journal*, v. 26, Sept. 1947, p. 776.

Procedures and equipment used by International Railway Car and Equipment Manufacturing Co.

22-526. Lead Welding Practices. L. S. Bowser. *Welding Journal*, v. 26, Sept. 1947, p. 777-781.

Recommended techniques for various forms (sheet, pipe, etc.), including surface preparation.

22-527. All-Welded Structure in Canada Leads in Economy, Strength and Appearance. M. N. Vuchnich. *Welding Journal*, v. 26, Sept. 1947, p. 782-783.

Design details on the first all-welded structure of its kind in Canada—entirely fabricated by arc welding and without the use of erection bolts. This structure will house new shops for the manufacture of farm implements and equipment.

22-528. Failures in Guided Bend Qualification Test Often Due to High-Tensile Pipe. L. K. Stringham. *Welding Journal*, v. 26, Sept. 1947, p. 784-785.

Test shown to be unsatisfactory for use in tryouts for welding personnel, or for electrode evaluation. It can be made to fail a good operator or pass a poor one by proper choice of pipe.

22-529. All-Welded Metal Casket. W. P. Brotherton. *Welding Journal*, v. 26, Sept. 1947, p. 786-787.

Production of high-quality, chromium-nickel alloy casket shells on a moving assembly line similar to that used in the manufacture of automobiles.

22-530. A Weldability Test for Sheet Metal in Oxy-Acetylene Welding. R. Woirin. *Welding Journal*, v. 26, Sept. 1947, p. 790.

An evaluation of the test proposed by Linde Air Products Co. in 1930, in which a 6-in. square sheet is fused without burning and a hole then melted in it. Present research indicates desirability of using diameter of hole rather than time of perforation as a criterion of weldability. (Translated and condensed from "Un Essai de Sondabilite Operatoire", *Sondureet Technique Connexes*, v. 1, March-April 1947, p. 48-55.)

22-531. Inert-Arc Welding Stainless Steel Belt. M. J. Conway. *Welding Journal*, v. 26, Sept. 1947, p. 791-792.

Technique used for job in which a 200-ft. strip of Type 302 stainless steel, 36 in. wide and 0.30 in. thick, was successfully welded into an endless belt by using the inert-arc welding process with the sheets slightly overlapped at the start of the weld.

22-532. Notched-Bead Slow-Bend Tests of Carbon-Manganese Steels. C. B. Voldrich, D. C. Martin and O. E. Harder. *Welding Journal*, v. 26, Sept. 1947, p. 489s-507s.

Usefulness of the test; effects of C and Mn on weldability; and effects of notch depth and of plate thickness. Variations between normalized and as-rolled specimens, and the effects of different heat inputs and different types of electrodes.

22-533. A Note on the Shrinkage and Distortion of Welded Joints. F. Guyot. *Welding Journal*, v. 26, Sept. 1947, p. 519s-529s.

A theoretical and experimental analysis. Application of the curves and equations developed to a number of practical problems. (Translated from *Arcos*, no. 100, 1946, p. 2357-2380; no. 101, 1946, p. 2399-2404.)

22-534. $H = kRI^2t$. A Useful Approach to Resistance Welding. (Concluded.) B. G. Higgins. *Sheet Metal Industries*, v. 24, Sept. 1947, p. 1843-1852.

Formula for the heat involved in resistance welding. Preparation of good fits between parts to be welded; electrode-tip diameter; electrode pressure and current initiation; mechanical and air-operated machines; mechanical toggle-operated machines; forging pressure; welding current; oscilloscope tests; results of excessive contact resistance; a common cause of bad welds; power-factor correction; welding time; ignitron contactors; electronic control of seam welders.

22-535. The British Welding Research Association's Symposium on the Welding of Light Alloys. The Welding of Aluminum-Magnesium Alloys. E. A. G. Liddiard. *Sheet Metal Industries*, v. 24, Sept. 1947, p. 1857-1860, 1862.

A condensed description of work done during the past three years. Data on the favorable mechanical properties of the Al-Mg alloys, and the principal difficulties in making sound welds. Studies of the nature of the oxide film and of surface reactions

(Turn to page 44)

Thielemann Explains Stress-Rupture Tests For Superalloys

Reported by Joseph A. Tinsman

Metallurgist, Gilbert & Barker Mfg. Co.

The limitations of jet propulsion and gas turbine engines as aircraft power plants are closely related to the properties of the materials available, R. H. Thielemann pointed out in addressing the Springfield Chapter ⚙ at its last meeting in the spring. Mr. Thielemann, who is in the engineering department of Pratt and Whitney Aircraft, spoke on "The Application of Metals to Jet Propulsion and Gas Turbine Engines".

The superalloys which were developed under the impetus of wartime research require drastically new fabricating and processing techniques, he said; their successful application demands that their physical and mechanical properties be properly evaluated and understood.

In order to evaluate the properties of a material for gas turbine service, many and varied tests are required. The simple tension test conducted at either room or elevated temperatures is at best only an indication of the long-time high-temperature load-carrying ability of the material. For design purposes, the rupture, creep and fatigue properties of the material must be determined for the temperature and life that are contemplated.

The stress-rupture method of testing, Mr. Thielemann explained, consists of loading several test specimens all at the same temperature but at different values of stress. The stresses applied are of sufficient magnitude to produce failure in times ranging from a few hours to possibly a few thousand hours. Elongation measurements should be made at regular time intervals. The tests are allowed to run until failure has occurred.

If the alloy is metallurgically stable, a straight-line relationship will exist between stress and hours to failure. Long-time rupture tests have shown that this line can safely be extrapolated to longer periods of time. A similar set of tests must be run for various temperatures. Graphs were shown to illustrate the yearly progress in the development of alloys for service at 1200 and 1500° F. from 1939 until the present time.

Carpenter Promotes Two

Vice-president and technical director is the new title conferred on Berton H. DeLong ⚙ by Carpenter Steel Co., where he has been employed since 1910. Mr. DeLong was formerly vice-president and chief metallurgist.

At the same time George V. Luerssen ⚙ has been promoted from assistant to chief metallurgist. Mr. Luerssen has been associated with Carpenter since 1907. Also a long-time member of the A.S.M., he was chairman of the important Metals Handbook Committee which has had charge of the revisions on the new edition, soon forthcoming.

A. M. McWilliams Dies, Was N. J. Past Chairman

Alexander Moore McWilliams, one of the founders and the fourth chairman of the New Jersey Chapter ⚙, died at his home in Denville, N. J., on Thursday, Sept. 11, at the age of 55. He was president of the McWilliams Forge Co. of Rockaway, N. J.

A Jerseyman all his life, Mr. McWilliams achieved distinction in business and civic affairs, as well as in his technical society activities. He was a former chairman of the Caldwell, N. J., Borough Council, and a member of that council for nine years. He was active in the founding of the New Jersey Chapter ⚙ in 1929, and his energy and ability to lead and inspire others brought him quickly to the chairmanship of the young chapter, a post which he filled with distinction in 1932-1933. Since then he maintained an active interest in the growth of the chapter, and his advice was continually sought by the directors as a group and by his many personal friends among the membership. FRED P. PETERS

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with moisture at elevated temperatures show that blistering is due to absorption of hydrogen by the alloys at various stages of fabrication. The extent of the gas absorption increases with the magnesium content and is affected by certain alkali and alkaline-earth-metal impurities. Recommendations are made to minimize the trouble and data are given showing the properties of welds made by the recommended methods.

For additional annotations indexed in other sections, see: 3-294; 12-171; 15-32; 23-297-308-316-318-321-332-362-363-364; 24-260-261-273-278; 25-122-144; 27-171-208.

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597 brief digests covering all published developments in this field during 1946 appear in Vol. 3, ASM Review of Metal Literature. Vols. 1, 2 and 3 together give you three-year index to the metal industry. Each Vol. $10.00 to ASM Members. $15.00 to Nonmembers. American Society for Metals, 7301 Euclid Ave., Cleveland 3.

23 INDUSTRIAL USES and Applications

23-283. Fabrication of the Crosley Engine. Paul Klotsch. *Steel Processing*, v. 33, July 1947, p. 409-411.
New four-cylinder automobile engine has cylinder block fabricated from steel stampings, steel tubing and screw machine parts. Design and construction.

23-284. Stampings Find Wide Application in Home Construction. *Steel Processing*, v. 33, July 1947, p. 420-423.
Applications in utility units, furnaces, bath tubs, stairs, doors, awnings, roofing, hardware.

23-285. Prefabricated Aluminum Buildings. Philip Murray. *Light Metal Age*, v. 5, July 1947, p. 11-13, 17.
Design and construction of units produced in Britain.

23-286. Aluminum in Trailer Construction. *Light Metal Age*, v. 5, July 1947, p. 15.
Design and construction of trailer coaches by Westcraft, Inc., Los Angeles.

23-287. An Experiment With Tungsten Carbide Bits. C. W. Nicolson. *Mining Congress Journal*, v. 33, July 1947, p. 36-37, 61.
Experiments indicate economy of tungsten carbide bits; where no chert or hard rock is encountered, 100 to 150 ft. of iron ore can be drilled without resharpening.

23-288. Selling Magnesium in Canada. A. C. Norcross. *Modern Metals*, v. 3, July 1947, p. 12-14.
Miscellaneous magnesium items. Potential users of magnesium; reaching the prospect.

23-289. Aluminum Water Pump. *Modern Metals*, v. 3, July 1947, p. 15.
Automotive pump is competitive with conventional cast iron type and weighs 40% less. Other advantages.

23-290. Aluminum Jeep Tops. J. A. Carson. *Modern Metals*, v. 3, July 1947, p. 16.
Advantages; construction and assembly.

23-291. Designing a Combination Lighter and Cigarette Case. Fred F. Fukal. *Modern Metals*, v. 3, July 1947, p. 20-21.
Aluminum die castings, stampings and drawn light-gage sheet used.

23-292. Precision Trailer Coaches. *Modern Metals*, v. 3, July 1947, p. 27.
Application of aluminum in coaches made by Westcraft, Inc.

23-293. Bus Bodywork. *Automobile Engineer*, v. 37, July 1947, p. 258-260.
A system of prefabricated framework for passenger vehicles.

23-294. High-Duty Gears. *Automobile Engineer*, v. 37, July 1947, p. 273-274.
Manufacture of special reduction gearing, made of nickel-chromium casehardened steel.

23-295. Hangars of Structural Steel. *Steel Construction Digest*, v. 4, July 1947, p. 3-7.
Illustrates and describes above application.

23-296. Silver-Clad Copper Wire. *Wire Industry*, v. 14, July 1947, p. 374.
Reviews contents of publication of the London Electric Wire Co., which deals with "Anacos" silver-clad copper in wire, strip, bars, rods, and sections, which are now available in commercial quantities.

23-297. Production Welding of Freight Cars on A. C. F. Assembly Lines. *Railway Age*, v. 123, Aug. 2, 1947, p. 34-35.
Procedures and equipment used by American Car & Foundry Co., at Berwick, Pa.

23-298. Lowering Production Costs of Bumpers and Springs. Howard Laurent. *Automotive Industries*, v. 97, Aug. 1, 1947, p. 24-26, 62.
What a Los Angeles parts manufacturer has done to modernize his plant for peacetime competition.

23-299. Stress-Relief Hardening of Beryllium Copper. Robert W. Carson. *Mechanical Engineering*, v. 69, Aug. 1947, p. 651-654.
The process and many of the applications made possible by its use.

23-300. Applications of Engineering Parts, Materials and Processes. *Machine Design*, v. 19, Aug. 1947, p. 160.
Broaching of brake ratchets; use of strain gages to determine rolling mill pressures; and use of lead casing for fan handling H_2SO_4 vapors.

23-301. Production of Magnesium Alloy Castings; Some Commercial Applications. (Concluded.) G. B. Partridge. *Metallurgia*, v. 36, July 1947, p. 125-132.
Some factors influencing the use of magnesium alloy castings in general engineering. Cost and design characteristics.

23-302. Aluminum Foil—Foe of Condensation. Alexander Schwartz. *Insulation*, v. 5, July 1947, p. 10-15.
Application to building construction.

23-303. Magnesium Alloys; Their Value in Engineering Applications. F. A. Fox. *Metal Industry*, v. 71, July 25, 1947, p. 63-66; Aug. 1, 1947, p. 86-88, 90.
Properties which render them suitable for peacetime commercial uses.

23-304. Finds Metal Cheaper Than Fabric in Manufacturing Personal Plane. *SAE Journal*, v. 55, Aug. 1947, p. 98, 100.
A cost comparison. (Based on "Comparison of Use of Mixed Structural Materials and Fabric Covering to All-Metal Construction for Personal Aircraft from a Manufacturing Viewpoint," by Walter C. Jamouneau.)

23-305. Ring Gears Formed From Steel Bar Stock. Kenneth Rose. *Materials & Methods*, v. 26, Aug. 1947, p. 74-77.
Starter ring gears made by a new series of steps with a number of manufacturing economies.

23-306. Magnesium Replaces Fabric for Aircraft Control Surfaces. R. E. Saunders. *Materials & Methods*, v. 26, Aug. 1947, p. 88-92.
A change to sheet magnesium resulted in greater strength, fewer parts, less weight, lower tooling costs and a worthwhile saving in labor.

23-307. Porcelain Enameled Moldings for All-Steel Poster Panels. H. H. Wineburgh. *Finish*, v. 4, Aug. 1947, p. 19-20, 52.
Cooperative development of Outdoor Advertising Assoc. of America offers new outlet for porcelain enamel.

23-308. Fabrication and Welding of Oil-Fired Water Heaters. W. R. Persons. *Machinery*, v. 53, Aug. 1947, p. 138-139.
Procedures and equipment used by Hoosier Industries, Inc., LaPorte, Ind.

23-309. A Gagemaker's Ten-Station Die. Al Morency. *Tool & Die Journal*, v. 13, Aug. 1947, p. 67-68.
Operation and applications of above die as an example of trend toward the building of complex mass-production dies by gagemakers.

23-310. Metallurgical Considerations of Gas Turbines. N. L. Mochel. *Transactions of the A.S.M.E.*, v. 69, Aug. 1947, p. 561-568; discussion, p. 568.
Testing methods and equipment. The design and application of materials to specific hot parts of gas turbines.

23-311. Materials for Power Gas Turbines. C. T. Evans, Jr. *Transactions of the A.S.M.E.*, v. 69, Aug. 1947, p. 601-608.
Materials used in the construction of the first power gas turbine built by Elliott Co. and reasons for selection.

23-312. Die Castings as Inserts. *Die Castings*, v. 5, Aug. 1947, p. 17, 37-39.
Some of the factors in molding a plastic shape over a die-cast insert.

23-313. Duplicator Redesign. Joseph Palma, Jr. and Max E. Toby. *Die Castings*, v. 5, Aug. 1947, p. 18-20, 39-43.
Many small machine assemblies in Niagara stencil duplicator have been replaced by die castings to eliminate wasteful handwork.

23-314. Following a Successful Pattern. *Die Castings*, v. 5, Aug. 1947, p. 21, 43-45.
Application of aluminum-alloy die castings to cloth cutting machine.

23-315. Focus on Performance. Milford B. Moore. *Die Castings*, v. 5, Aug. 1947, p. 32-37.
Use of die castings to replace fabricated or wooden parts in new line of cameras.

23-316. Fabricating Methods for Rail Steel. *American Machinist*, v. 91, Aug. 14, 1947, p. 147.
Punching, shearing, and arc welding.

23-317. New Developments in Tungsten Carbide. A. R. Zapp. *Wire and Wire Products*, v. 22, Aug. 1947, p. 591-593, 612-614.

23-318. Railroads Demand More Strength and Less Weight. Pierre Champion. *Industry and Welding*, v. 20, Aug. 1947, p. 34, 36.
Fabrication of welded steel parts and assemblies for railroad cars.

23-319. Comptoirs de Bars en Aluminium. (Aluminum Bar Counters.) Guy Bourrague. *Revue de l'Aluminium*, v. 24, no. 133, May 1947, p. 171-177.
The use of aluminum in various types of counters and sinks; and details of their construction.

23-320. Un Moteur De 3500 CV: Le Rolls-Royce "Eagle". (A 3500 Hp. Engine: The Rolls-Royce "Eagle".) Leonce Keuleyan. *Revue de l'Aluminium*, v. 24, no. 133, May 1947, p. 178-182.
Construction and use of aluminum in this engine.

23-321. Ingenious Technique for Biggest Inch Pipe Fabrication. Gilbert M. Wilson. *World Oil*, v. 126, Aug. 18, 1947, p. 78-82.
The fabrication process—continuous welding of the longitudinal seams; hydraulic expansion of the welded pipe sections to produce a thinner walled, yet higher yield strength pipe.

23-322. A New Mold Development for Low Pressure Technique. William Schack. *Plastics*, v. 7, Aug. 1947, p. 54, 70.

(Turn to page 46)

Properties of Steel

Speaking of toughness of hardened steels, M. A. Grossmann (3-76, June 1946) emphasized the inherent contradiction between toughness and hardness by paraphrasing a well-known quotation: "If all the persons who seek high hardness without sacrifice of toughness were laid end to end, it would be a good thing." In enumerating factors which lower the toughness of hardened steels, Grossmann singled out free ferrite precipitated along grain boundaries. He attributes this influence to the inability of the free ferrite to flow (and absorb energy during flow) because it is bo..led as a thin layer, between hard masses of martensite. The loss in toughness of hardened steels tempered at 400 to 500° F., as compared with lower or higher temperatures, is explained by the relative changes in yield and cohesive strengths during tempering. Up to 400° F. the yield strength is lowered, while cohesive strength is practically unaffected; consequently, when the metal is stressed beyond the yield strength, it deforms somewhat more before reaching the cohesive strength. In the 400 to 500° F. range, the cohesive strength falls more rapidly than the yield strength, so there is less deformation, and toughness is decreased. At temperatures above 500° F., the yield strength decreases more rapidly than the cohesive strength, and the toughness, therefore, increases.

Causes of intergranular fractures in cast steels are enumerated by C. H. Lorig (3-155, Sept. 1946) as follows:

1. Aluminum nitride precipitation at the primary grain boundaries.
2. Ferrite precipitation as a network at the primary grain boundaries.
3. The so-called Type II, or network-sulphide inclusions.
4. Internal hot tears.

The association of aluminum nitride with intergranular type of fracture in cast steels is of particular interest in view of the fact that when nitrogen and aluminum are present in similar concentration in wrought steels, their influence on aging characteristics and subzero properties is believed to be very beneficial. The difference in behavior between cast and wrought steels may be due to *(a)* the breakdown of the primary grains during hot rolling, so that precipitated aluminum nitride no longer outlines grain boundaries, and *(b)* the relatively faster cooling of wrought bars in comparison with castings. As Lorig has indicated, the effectiveness of nitrogen and aluminum in inducing intergranular fractures is a function of the rate of cooling. For instance, a typical bessemer steel with 0.012% nitrogen, if deoxidized with 2 lb. of aluminum per ton of steel, will exhibit a tendency to intergranular fractures when its cooling rate is 500° F. per hr., or slower. A faster cooling rate will prevent intergranular fracture.

The fact that intergranular fracture ratings of cast steel embrittled with aluminum nitride are dependent upon cooling rate from solidification suggests the importance of temperature-time effects for precipitation of intergranular aluminum nitride. The nitride precipitate forms between 1700 and 1500° F., the precipitation temperature being lower for fast cooling and higher for slow cooling. A sufficiently fast cooling rate could thus completely prevent precipitation.

Solution of the precipitate is possible, but occurs at a considerably higher temperature than precipitation. Some solution was observed after 6 hr. at 2100° F.; higher temperatures increased the amount in solution. Aluminum nitride, therefore, evidences a sluggish behavior, with several hundred degrees spread between the solution and precipitation temperatures even at moderately long holding time. It is also significant that precipitation takes place preferentially at the grain boundaries, where the iron lattice is less stable and consequently most easily disrupted to accommodate a foreign nucleus.

An addition of 0.60% molybdenum largely suppressed intergranular fracture, and it was postulated that the massive molybdenum atoms effectively impede the diffusion of aluminum and nitrogen and thus greatly retard the precipitation of aluminum nitride at the grain boundaries. Boron seemed to have a mildly beneficial effect, principally because it is a denitriding agent.

Ferrite precipitation along primary grain boundaries was found to be the result of a chance combination of hardenability and cooling rate after solidification. Heat treating is effective in eliminating brittle fractures in such steels.

The formation of chain-like, or network-sulphide, inclusions has been thoroughly investigated in the past and requires no discussion.

The fourth cause of brittle fractures —the so-called hot tears—is a result of casting technique and does not lend itself to any remedial measures. It is post mortem evidence of unsatisfactory foundry condition.

Corrosion

Causes and prevention of drill pipe failures are a subject of absorbing interest to the user as well as to the supplier, because the stakes are so high. When a string of drill pipe fails, the loss of pipe is generally a s..all fraction of the total cost of such failure, since the "fishing" job may run into thousands of dollars, and may even necessitate abandoning a hole after it has been sunk a few thousand feet.

An investigation by L. R. Jackson, H. M. Banta, and R. G. McMaster on drill-pipe failures in the Permian Basin (6-83, Oct. 1946) includes both laboratory and field studies. The influence of stress level, chemical corrosion inhibitors, plastic coatings, effect of periodic cleaning and of brine concentration on operating life of steel under corrosion-fatigue conditions, are related to service performance.

In the fatigue studies on drill-pipe steel specimens it was found that operating life could be increased 10-fold by reducing the operating stress from 40,000 to 20,000 psi. Overstressing to 60,000 psi. (as might occur when drill strings are operated in compression) reduced the operating life 90%.

A 0.0005-in. coating of 80% phenolic resin and 20% polyvinyl butyral increased the corrosion-fatigue life of the specimens 20-fold. Even more effective was the protection afforded by a multicoat system which provides good adhesion in the primary layer and resistance to abrasion in the outer layer. For instance, a multicoat made of two coats of primer (60% Rezyl 99-5 and 40% Beckamine P-138) with a pigment composed of 40% zinc chromate, 40% iron oxide, and 20% zinc oxide, covered with two additional coats of the same plastic mixture without pigments, increased the fatigue life from 430,000 cycles to 63,000,000 cycles, under very severe conditions at 40,000 psi. fiber stress. The test was then discontinued without failure of the specimen. These tests were corroborated by field tests on coated drill pipe.

Use of inhibitors offers some promise in raising the corrosion-fatigue life of drill pipe. In a 7% salt solution (6.6% NaCl, 0.1% $MgCl_2$, 0.3% $CaCl_2$) the fatigue life was raised about 300% at 40,000 psi. fiber stress, when 0.5% or more sodium chromate was added to the corrosive medium. In dilute brine solutions (0.7% total salt), the fatigue life was raised about 600%. It is believed, therefore, that measures offering some protection to the pipe while drilling through the salt beds will be more effective in drilling the remainder of the hole, where the salt concentration in the drilling fluid is low.

Sodium chromate has been tried in field operations in a number of wells; however, there is no unanimity of opinion on the benefits derived, probably because of the masking effects of other variables in operating conditions of individual wells.

Another practice which appears to offer promise is periodic cleaning of the products of corrosion from the surface of the pipe. The fatigue life of laboratory specimens was nearly tripled when the corroded surface was cleaned off by vapor blasting with very fine grit. Judging from laboratory tests, a combination of various practices has more than an additive effect on fatigue life. If lowering the stress, for instance, increases fatigue life 10-fold, and periodic cleaning results in a 3-fold increase, a combination of both practices may increase the fatigue life as much as 100-fold.

Low-cost aluminum dies permit production of intricate designs with close tolerances, and needing minimum machine work.

23-323. Straight-Line Production Increases Product Output. *Production Engineering & Management*, v. 20, Aug. 1947, p. 64-72.

Equipment and procedures used in production of refrigerators.

23-324. Production Pipe Bending. L. G. Burnard. *Aircraft Production*, v. 9, Aug. 1947, p. 298-300.

Space limitations in an aircraft necessitate a large number of bends despite efforts to clean and straighten up the pipe runs. Power bending machine, construction, and operation; standardization of pipe runs.

23-325. Light Alloys in the Mining Industry. A. Roberts. *Mine & Quarry Engineering*, Aug. 1947, p. 229-235.

Use of light alloys in skips and cages in Great Britain mine trucks. Successful use has been made of light alloys for haulage shackles, props, bars, shovels, and other equipment, while experiments have been carried out with conveyer troughing made of light alloy.

23-326. Low-Cost Quantity Production. C. W. S. Parsons. *Western Metals*, v. 5, Aug. 1947, p. 13-14.

A study of western metalworking shops with particular reference to the Ford parts program.

23-327. Engraved Magnesium Plates Cut Printing Costs. Wm. J. Higgins. *Modern Metals*, v. 3, Aug. 1947, p. 28-29.

A new development for printing newspapers. The new process offers possibilities of saving 50% in the production costs of a newspaper.

23-328. A Metal Texturizing Process That Combines Strength With Beauty Makes Its Bid for Postwar Attention. Eugene W. Nelson. *Western Metals*, v. 5, Aug. 1947, p. 23-24.

"Rigidized metal" has strength or stiffness in all directions and is the product of a special patented process which creates a "clear-through" pattern in nearly any flat rolled metal, giving the sheets a third dimension.

23-329. Developments in the Use of Aluminum for Food Containers. Rene Chevillotte. *Sheet Metal Industries*, v. 24, Aug. 1947, p. 1583-1586, 1590.

Effect on health; forming of cans; types of cans; behavior of cans toward corrosive action of food products.

23-330. Tipping Coal-Cutter Picks With "Hardmetal". L. Wachtel. *Colliery Guardian*, v. 175, Aug. 1, 1947, p. 165-168.

Benefits, techniques, and costs of tipping coal-cutter picks with an extremely hard and abrasion resistant medium.

23-331. Interest Is Renewed in Magnesium as Metal for Photo-Engraving. *Editor & Publisher*, v. 80, Aug. 9, 1947, p. 58.

Relative costs and other advantages and disadvantages.

23-332. Crosley Builds a 59-Lb. Engine. Chester Ricker. *American Machinist*, v. 91, Aug. 28, 1947, p. 85-89.

How 120 lightweight parts are brazed together at 150 points to build the Crosley engine with minimum machining. The 4-cyclinder, overhead-valve engine is unique in having an all-steel copper-brazed cylinder block mounted on a permanent-molded crankcase of aluminum alloy.

23-333. In the Service of Science. *Light Metals*, v. 10, Aug. 1947, p. 408-417.

The uses of aluminum and magnesium in the construction of scientific and technical apparatus for use in the laboratory and the field. Low inertia, adequate strength; water distillation; hydrogen peroxide; fabrication and finishing characteristics of aluminum-base alloys; optical instruments; front-surfaced reflectors; other applications of evaporated aluminum films. (To be continued.)

23-334. Light Alloys in the Internal Combustion Engine. *Light Metals*, v. 10, Aug. 1947, p. 425-430. (Continued.)

Factors influencing the use of light alloys for cylinder heads, cylinders, blocks and crankcases. The importance of weight reduction and high conductivity of heat. (To be continued.)

23-335. The Production of British Clearing Heavy Presses. *Machinery (London)*, v. 71, Aug. 7, 1947, p. 143-149.

Methods employed at the Works of Vickers Armstrong, Ltd., Newcastle-on-Tyne, England.

23-336. Aluminum in Rolling Stock. *Locomotive Magazine and Railway Carriage and Wagon Review*, v. 53, June 14, 1947, p. 89.

Use of aluminum for various parts.

23-337. Minerals for Chemical and Allied Industries. Sydney J. Johnstone. *Industrial Chemist*, v. 23, Aug. 1947, p. 529-537.

Magnesium metal, magnesia refractories; dolomite. (To be continued.)

23-338. Mass Producing Hollow Metal Door Frames. *Iron Age*, v. 160, Sept. 4, 1947, p. 71.

Methods and equipment used by Diebold, Inc., Canton, Ohio.

23-339. Ferguson Tractor Production by the Standard Motor Co., Ltd. *Machinery (London)*, v. 71, Aug. 14, 1947, p. 171-182.

Production procedures and equipment.

23-340. Continuous Lining of Corrugated Steel Waterproofs Reconstructed Tunnel. John F. Laboon. *Engineering News-Record*, v. 139, Sept. 4, 1947, p. 34-36.

Effectiveness of continuous corrugated sheet-metal lining in producing a watertight condition under extremely adverse conditions.

23-341. Aluminex Roof Glazing. *Aluminium and the Non-Ferrous Review*, v. 12, April-June 1947, p. 36-37.

New type of aluminum window frame for skylights.

23-342. Copper and Its Alloys. E. Voce. *Metal Industry*, v. 71, Aug. 29, 1947, p. 163-166.

Applications in marine and allied engineering.

23-343. Aluminum Alloys. E. G. West. *Metal Industry*, v. 71, Aug. 29, 1947, p. 173-176.

The utilization of light metal for marine purposes.

23-344. Standardization Accelerates Turbine Output. *Steel*, v. 121, Sept. 8, 1947, p. 80-81.

Steps in production of turbines at Fitchburg, Mass., plant of General Electric are illustrated.

23-345. New Expediting Techniques Proved in XB-48 Production. Irving Stone. *Aviation Week*, v. 47, Sept. 8, 1947, p. 26, 29-30.

Fabrication techniques in production of experimental jet bomber by Glenn L. Martin Co.

23-346. Gas Turbines. H. R. Zschokke and K. H. Niehus. *Iron and Steel*, v. 20, Aug. 1947, p. 398-400; discussion, p. 407-409.

Requirements of a suitable steel for turbines for varied applications. Corrosion of the combustion chamber.

23-347. Metallized Circuits Reduce Wiring Costs. John T. Collier. *Electrical Manufacturing*, v. 40, Sept. 1947, p. 116, 118.

Production of Spraywire circuits.

23-348. Aluminum Foil Makes Ideal Honeycomb. *Aluminum Bulletin*, v. 1, Sept. 1947, p. 3.

Use of honeycomb paneling as a packaging, insulating, and labeling material.

23-349. An Old Business Goes Modern. Hannibal Coons. *Steelways*, Sept. 1947, p. 1-5.

Applications of stainless and other steels in the wine industry.

23-350. The Miracle of Steel and Penicillin. Helen Worden. *Steelways*, Sept. 1947, p. 9-12.

Uses of steel in manufacture of penicillin.

23-351. These Wheels Carry a Pedigree. *Steelways*, Sept. 1947, p. 25-26.

Manufacture of wrought steel railroad car wheels.

23-352. Spray-Installing Electrical Circuits. John T. Collier. *Steel*, v. 121, Sept. 15, 1947, p. 96, 110.

Conventional wire—fed into guns—is converted into flat conductive strips embedded in dielectric panels.

23-353. Miracle of Metallurgy Sires New Timepiece Accuracy. *Inco Magazine*, v. 21, Summer 1947, p. 4-7.

Manufacture of hairsprings for Hamilton watches from "Elinvar Extra" alloy (41 to 43% Ni, 2.2 to 2.6% Ti, 5.1 to 5.7% Cr, 0.06% C, 0.3 to 0.6% Mn, 0.3 to 0.6% Si, 0.4 to 0.8% Al, 0.04% P, 0.04% S, and balance Fe).

23-354. New Tubing Can Cut Costs Between 20% and 65%. *Inco Magazine*, v. 21, Summer 1947, p. 17.

Spiralock tubing can be custom-made to a variety of sizes and shapes without extra cost. It is made from cold rolled metal strip by spiral-forming the strip into tubular shapes.

23-355. Corrosion Eliminated Through Use of Lectro-Clad Pipe. S. G. Bart. *Paper Mill News*, v. 70, Aug. 23, 1947, p. 78-80, 90.

Lectro-clad pipe is nickel-lined pipe developed to take the place of nickel or stainless steel. Properties, applications, and fabrication procedures, with special reference to its use in the pulp and paper industry.

23-356. Cast Bolts for Pipe Joints. C. K. Donoho. *Mechanical Engineering*, v. 69, Sept. 1947, p. 739-742.

Mass production of bolts by the use of metal molds and short cycle annealing. Experimental results show satisfactory mechanical and corrosion resistant properties. An austenitic malleable bolt with unusual strength, ductility, and corrosion resistance has also been developed for special services. (Presented at semi-annual A.S.M.E. meeting, Chicago, June 16-19, 1947.)

23-357. Product Design for a Crowded Market. A. F. Fukal. *Die Castings*, v. 5, Sept. 1947, p. 19, 32, 34.

An improved cigarette lighter utilizing aluminum die castings.

23-358. Measuring the Potential. C. A. Blakeslee. *Die Castings*, v. 5, Sept. 1947, p. 20-24, 26, 28-29, 41-45.

Use of die castings in Bristol recording and controlling potentiometers. 32 complex types of instruments can be constructed from two basic assemblies.

23-359. Die-Cast Rotors. J. J. DeWindt and G. L. Ringland. *Die Castings*, v. 5, Sept. 1947, p. 30-31, 46-47.

Manufacture of aluminum die-cast rotors.

23-360. Light Weight for Heavy Duty. *Die Castings*, v. 5, Sept. 1947, p. 36-40.

Use of aluminum die castings for chain hoists.

23-361. Use of Die Castings Grows With Development of Better Production Equipment. *Steel*, v. 121, Sept. 22, 1947, p. 95.

Trends and the development of new applications.

23-362. Lightweight All-Welded Steel Trailer for Transporting Heavy Construction Equipment. C. W. Lytton. *Welding Journal*, v. 26, Sept. 1947, p. 770.

23-363. All-Welded Prefabricated Sandwich Shops Shipped Completely Assembled Anywhere in the United States. R. H. Davies. *Welding Journal*, v. 26, Sept. 1947, p. 788-789.

Manufactured by Valentine Industries, Inc., Wichita, Kan.

23-364. Welded Steel Container. T. M. Fallon. *Welding Journal*, v. 26, Sept. 1947, p. 793.

A 277-cu.ft. welded steel (interlocking) weathertight shipping container designed to carry loads up to 12,000

(Turn to page 48)

Metals for Steam Turbines And Turbo Superchargers Reviewed by Mochel

Reported by Hans J. Heine

Metallurgist, Rockwell Mfg. Co.

An important, rapidly developing branch of metallurgy—namely, application of materials at high temperatures—was discussed by N. L. Mochel, manager of metallurgical engineering, steam engine department, South Philadelphia Works, Westinghouse Electric Corp., before the Pittsburgh Chapter last spring. Mr. Mochel introduced his subject by showing the enormous increase during the past two decades in steam turbine performance factors, such as pressures, revolutions per minute, and temperature at throttle.

Turbo superchargers, he said, involve a gas turbine which is simple in design and small in size; efficiency is of minor importance. The latest applications are for jet engines in guided missiles and planes. In these military applications cost is not a factor, nor is life, since the time of service is often less than an hour.

Testing equipment, as used by Westinghouse, was discussed at length. Mr. Mochel suggested the use of the "four-square relationship" between stress, temperature, allowable deformation, and time (expected service life). If creep enters the picture, balance of these four variables must be maintained. Careful measurement of relaxation of loads and stresses at high temperatures is paramount, he pointed out, and the strain rate should be considered in creep-rupture testing. Another important property is seizing and galling, since no packing can be applied at high temperatures.

Mr. Mochel then mentioned the evolution of reaction blade design. Today these blades are precision cast of high alloys. Forged parts cannot be used, for service temperatures show an increasing trend to approach forging temperatures. Sintered powder materials are excluded because parts cannot be fashioned to close enough tolerances. Ceramics are not applicable because of their low load-bearing capacity and other limiting properties.

Sintercast Corp. Formed

A new corporation devoted to consultation, research and development in the field of powder metallurgy—Sintercast Corp. of America, New York City—has been formed by Erwin Loewy, president of Hydropress, Inc., and two associates, Claus G. Goetzel and John Ellis. The new organization is establishing complete research and pilot production facilities, so that it can carry clients' projects through laboratory development to full-scale production.

Metallographic Techniques Taught at Cleveland

Specialized metallographic techniques in three different fields of metallurgy are being taught in a series of educational lectures sponsored by the Cleveland Chapter. The first lecture, on ferrous materials, was presented on Oct. 13 by Prof. G. M. Cover of Case Institute of Technology. On Nov. 10 H. P. Croft, director of technical control and research, Chase Brass and Copper Co., Inc., will take up copper and copper alloys, and on Dec. 8 A. M. Montgomery, research metallurgist for Aluminum Co. of America, will lecture on the light alloys, aluminum and magnesium.

Some of the topics to be discussed will be the selection of specimens, micro versus macro examination, mechanical versus electropolishing, etching methods, identification of constituents, interpretation of structures, and correlation of metallographic findings to processing methods. Question and discussion periods follow each meeting.

The spring series of the Cleveland Chapter will consist of two lectures on brazing, to be presented next March 8 and 15. At the first meeting, A. M. Setapen, of Handy & Harman, will discuss low-temperature brazing, and at the second, H. M. Webber of General Electric Co. will lecture on high-temperature brazing.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933

Of **Metals Review**, published monthly at Cleveland, Ohio, for October 1, 1947, State of Ohio, County of Cuyahoga, ss. Before me a Notary Public in and for the State and county aforesaid personally appeared Ray T. Bayless, who, having been duly sworn according to law, deposes and says that he is the Business Manager of **Metals Review** of the American Society for Metals, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, to wit:

1.—That the names and addresses of the publisher, editor, managing editor, and business manager are: Publisher, American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio; Editor, M. R. Hyslop, 7301 Euclid Ave., Cleveland; Managing Editor, M. R. Hyslop, 7301 Euclid Ave., Cleveland, O.; Business Manager, Ray T. Bayless, 7301 Euclid Ave., Cleveland, O.

2.—That the owner is: The American Society for Metals, 7301 Euclid Ave., Cleveland, O., which is an educational institution, the officers being: President, A. L. Boegehold; Vice-President, F. B. Foley; Secretary, W. H. Eisenman; Treasurer, H. K. Work; Trustees: C. H. Herty, Jr., John Chipman, W. E. Jominy, J. E. Dorn and A. E. Focke. All officers as above, 7301 Euclid Ave., Cleveland, Ohio.

3.—That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages or other securities are: None.

4.—That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

Ray T. Bayless, Business Manager

Sworn to and subscribed before me this 1st day of October, 1947. (Seal) Genevieve G. Fitzgerald, Notary Public. (My commission expires March 26, 1949.)

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2-216; 22-529; 25-127.

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24 DESIGN

24-256. Stresses in Glass-to-Metal Bead Seals at Room Temperature. G. D. Redston and J. E. Stanworth. *Journal of the Society of Glass Technology*, v. 30, Aug-Oct. 1946, p. 201-216.

A photo-elastic study was made of the distribution of the retardations due to axial stresses and to radial and hoop stresses in bead seals. Seals of varying glass-metal radius ratio were tested. Observed distributions of retardation agreed substantially with those derived from mathematical theory. Direct stress determinations however, were unreliable with seals of high glass-metal radius ratio, and also with short seals.

24-257. The Effect of Heat Treatment in Different Atmospheres on the Stress in Tungsten-to-Glass Seals. M. Manners. *Journal of the Society of Glass Technology*, v. 30, Aug-Oct. 1946, p. 217-238.

Effect of heat treatment in air and hydrogen on the longitudinal stress at the glass-to-metal boundary of cylindrical single-wire seals, and of the relationships between stress and time, and stress and temperature for "oxide" and "oxide-free" seals. Observed changes in stress were correlated with changes in physical and chemical conditions at the interface.

24-258. Generation of the Conic Sections With Machine Tools. R. T. Hinkle. *Product Engineering*, v. 18, Aug. 1947, p. 162-165.

How theorems from projective geometry can be duplicated by kinematic linkages for the generation of the ellipse, hyperbola, and parabola. Basic machine dimensions are analyzed and the conversion of design dimensions of parts into machine settings for production.

24-259. Limitations on Precision Cast Parts. Nicholas J. Grant. *Iron Age*, v. 160, Aug. 7, 1947, p. 62-66.

A series of investigations made on cast turbine-rotor blades which indicate that the performance of certain extreme sizes and shapes of blades cannot be entirely evaluated on the basis of creep and rupture tests.

24-260. Welding as Applied to Military Bridging. R. A. Foulkes. *Transactions of the Institute of Welding*, v. 10, June 1947, p. 78-89; discussion, p. 89-91.

The problems facing the designer of military bridges; the differences in the requirements of civilian and military design. The part played by welding.

24-261. Design and Cost of Welded Structures. E. C. Moore. *Transactions of the Institute of Welding*, v. 10, June 1947, p. 92-96.

Machine parts such as machine tool beds and columns, press heads and bases, guillotine shear frames, hammer columns, and similar constructions produced by welding.

24-262. Transverse Vibrations of Bars and Fatigue Fractures. P. Mathieu. *Engineers' Digest (American Edition)*, v. 4, July 1947, p. 330-334.

Theoretical mathematical developments of two cases: free vibrations of a bar fixed at one end, especially vibrations caused by shock; and transverse vibrations of a tapered bar. (Concluded.) (Translated and condensed from *Schweizer Archiv*, v. 12, Nov-Dec. 1946, p. 329-338, 361-372.

24-263. Performance Tests of Wire Strain Gages. Part V. Error in Indicated Bending Strains in Thin Sheet Metal Due to Thickness and Rigidity of Gage. W. R. Campbell and A. F. Medbery. *National Advisory Committee for Aeronautics Technical Note No. 1318*, July 1947, 11 p.

Results of tests for 15 types of single-element multistrand wire strain gages. In most cases the indicated extreme fiber-bending strain was greater than the actual strain.

24-264. Utilizing Mechanical Properties in Die Casting Design. Part V. Members Subjected to Repeated or Fatigue Loads. Joseph Marin. *Die Castings*, v. 5, Aug. 1947, p. 22, 25-26, 28.

Improved product design based on a thorough consideration of mechanical properties and stress analysis.

24-265. Riveted Assemblies. H. K. Barton. *Die Castings*, v. 5, Aug. 1947, p. 15-16, 45-48.

Some of the factors to consider in design.

24-266. Materials & Methods Manual 29: Screw Machine Products. T. C. Du Mond. *Materials & Methods*, v. 26, Aug. 1947, p. 103-110.

There are relatively few limitations on screw machine products if their design conforms to a few basic specifications. A wide range of materials is suited to machining by this process. Economics of screw machine products, and Swiss automatic products.

24-267. Designing Forming Dies Along Natural Flow Lines. Charles O. Herb. *Machinery*, v. 53, Aug. 1947, p. 131-136.

How forming dies for drop-hammers and power presses are developed by the Sol-A-Die process to eliminate thinning of sheet-metal sections.

24-268. Design Charts for Flat Compression Panels Having Longitudinal Extruded Y-Section Stiffeners and Comparison With Panels Having Formed Z-Section Stiffeners. Norris F. Dow and William A. Hickman. *National Advisory Committee for Aeronautics Technical Note No. 1389*, Aug. 1947, 76 p.

For 24S-T (bare sheet) and 75S-T (Alclad sheet) aluminum-alloy panels. Comparisons are made among panels designed from these charts and panels designed from other design charts.

24-269. How to Apply the Formula for Involute Sliding. Ben Bloomfield. *American Machinist*, v. 91, Aug. 14, 1947, p. 121-122.

Use of formula. Calculations for four examples.

24-270. New Lock Joint for Sheet Metal Structures. *Iron Age*, v. 160, Aug. 14, 1947, p. 80.

See *Sheet Metal Industries*, May 1947.

24-271. Designing Tools for Screw Machine Production; Part XII. Roy M. Spaulding. *Screw Machine Engineering*, v. 8, Aug. 1947, p. 71-74.

Flat form tools; top-rake for flat tools; the four steps taken in compiling the necessary calculations.

24-272. Redesign Increases Mill Motor Ratings. C. B. Hathaway. *Iron Age*, v. 160, Aug. 21, 1947, p. 78-79.

Careful redesign of mechanical and electrical components, especially of the armature, bearings and bearing housings, and field coils, has made it possible to produce a line of mill motors with the ratings reduced one frame size. There is no change in the mounting dimensions or shaft extension for a given frame size. A new type 100-hp. 550 v. motor.

24-273. Welded Girder Sustains High Stresses in Test at 0° F. La Motte Grover. *Engineering News-Record*, v. 139, Aug. 21, 1947, p. 90-91.

The fourth of a series of six, 9-ton, welded steel box girders, which was subjected to a static load test at 0° F. deflected nearly 9 in. on a 22-ft. span before it fractured. The modulus of rupture was computed to be 80,000 psi. Part of an investigation to determine the effect upon the capacity of a welded structural member of severe geometrical constraint against ductile behavior.

24-274. Design Progress in 1946. F. B. Dahle. *Metals Review*, v. 20, Aug. 1947, p. 5-7, 9.

A comprehensive survey of recent technical literature reflecting metallurgical aspects of design problems. Based on the A.S.M. Review of Current Metal Literature. Covers aviation design, automotive equipment, railroads and equipment, stresses and strains, casting, forging and stamping, tools and fixtures, building and structures, and fastening by welding, riveting and bolting.

24-275. Metallurgical Design and Industrial Applications. *Metals Review*, v. 20, Aug. 1947, p. 11, 13, 15, 17, 19, 21, 49.

Product manufacturers tell how and why metals are used in various ways. Tools of the designer; stress analysis equipment; materials; fabricating methods; assembly and finishing; design of mechanical elements; power units and electrical equipment; fasteners; light metal applications; miscellaneous product applications.

24-276. Transverse Vibrations of Bars and Fatigue Fractures. P. Matthieu. *Engineers' Digest (American Edition)*, v. 4, June 1947, p. 273-277. (To be continued.)

Fundamental mathematical analyses were made to determine the reasons for certain fatigue failures of propeller and steam-turbine blades and of rack bars of water power plants. The fractures were caused by periodic forces acting on, but not in resonance with, the blades. (Translated and condensed from *Schweizer Archiv*, v. 12, Nov. 1946, p. 329-338; Dec. 1946, p. 361-372.)

24-277. Some Engineering and Design Considerations in the Utilization of Ordinary and High-Strength Steels. William B. Brooks. *Welding Journal*, v. 26, Aug. 1947, p. 665-669.

Measurement of ductility; notch bar testing; effect of loading velocity; effect of temperature; significance of the notch bar test; influence of thickness; fatigue; influence of corrosion in fatigue. 18 ref.

24-278. Comment on Recent Trends in Concepts of Design for Welded Steel Structures. G. M. Boyd. *Welding Journal*, v. 26, Aug. 1947; discussion, p. 693-695.

Significance of box girder tests when studied against the background of the Charpy V-notch values. Comments on residual stresses; drop hammer tests; fatigue tests; plastic theory. Discussion of paper by La Motte Grover in November 1946 issue. 10 ref.

24-279. Report on the Fracture of Metals. Part I. Maxwell Gensamer, Edward Saibel and John T. Ransom; **Part II.** Maxwell Gensamer, Edward Saibel and Robert E. Lowrie. *Welding Journal*, v. 26, Aug. 1947, p. 443s-484s.

Part I surveys the present knowledge of the laws and fundamental

(Turn to page 50)

CHAPTER MEETING CALENDAR

CHAPTER	DATE	PLACE	SPEAKER	SUBJECT
Akron	Nov. 12	Akron Elks Club	John N. Ludwig, Jr.	The Use of Ferro-Alloys in the Production of Iron and Steel Castings
Baltimore	Nov. 17	Engineers Club	G. D. Welty	Germany's Light Alloy War Industry
Boston	Nov. 7	Sheraton Hotel	N. J. Grant	Metals at Elevated Temperatures
Buffalo	Nov. 13	Plant Visitation to Westinghouse Electric Corp. and Cornell Aeronautical Laboratory		
Buffalo	Nov. 15			Annual Dance
Chicago	Nov. 10	Furniture Mart Clubrooms	Reed H. Kelso	The Lady and the Home
Cincinnati	Nov. 13	Engineering Society	Stewart G. Fletcher and Ray P. Kells	Selection and Heat Treatment of Tool and Die Steels
Cleveland	Nov. 3	Cleveland Club	Bruce W. Gonser	Recent Advances in Nonferrous Metallurgy
Columbus	Nov. 19	Battelle Institute	Chas. A. Scarlott	Engineering for Tomorrow
Dayton	Nov. 12	Biltmore Hotel	C. S. Barrett	Metallography
Detroit	Nov. 10	Rackham Bldg.	J. C. Fox	Die Castings
Georgia	Nov. 3	Atlantic Steel Co.		Brass—Its Uses and Proper Applications
Golden Gate	Nov. 17	Engineers Club, San Francisco	C. G. Chisholm	Welding and Fabrication of High-Temperature Alloys
Hartford	Nov. 11	Hartford Trade School	Fred P. Peters	The Metallurgist's Place in the Changing Materials Picture
Indianapolis	Nov. 17	Marott Hotel	Walter Schlegel Harry Crump	Tools for Machining High Speed Steels Carbide Tools
Los Angeles	Nov. 20	Rodger Young Auditorium	R. Grange	New Developments in Modern Metallurgy
Manitoba	Nov. 11	Marlborough Hotel	T. O. Charles	Grinding Wheels
Mich. Col. M. & T.	Nov. 11	Clubhouse		Motion Pictures—The Making and Shaping of Steel
Milwaukee	Nov. 18	City Club of Milwaukee	A. B. Kinzel	Weldability
Montreal	Nov. 3	Queen's Hotel	G. R. Black	Recent Developments in the Uses of Aluminum
New Haven	Nov. 20	Hammond Laboratory, Yale University	E. H. Davis and W. V. Coleman	Buttons—Their Historical Aspect and Manufacturing Processes
New Jersey	Nov. 3	Essex House, Newark	E. J. Pavesic	Practical Problems in Commercial Heat Treating
New Jersey	Nov. 17	Essex House, Newark	Howard S. Avery	Cast Heat Resistant Alloys for Industrial Use
North West	Nov. 20	Covered Wagon	G. Vennerholm	Casting Methods in Automotive Manufacture
Northwest Pa.	Nov. 20	Meadville, Pa.	A. F. Holden	Salt Baths and Their Applications
Notre Dame	Nov. 12	Engineering Auditorium, University of Notre Dame	J. T. MacKenzie	Engineering Properties of Cast Iron
Ontario	Nov. 7	Royal York Hotel, Toronto	Gordon E. Willey	Material Specifications—a Criterion for Better Products at Lower Cost
Oregon	Nov. 21	Congress Hotel, Portland	C. G. Chisholm	Welding and Fabrication of High-Temperature Alloys
Penn State	Nov. 11	State College, Pa.	A. H. Geisler	Precipitation From Solid Solutions
Peoria	Nov. 19	Jefferson Hotel	J. F. Lincoln	
Philadelphia	Nov. 28	Engineers Club	Francis B. Foley	Alloys for Elevated Temperature Service
Pittsburgh	Nov. 13	Hotel Schenley	Francis Juraschek	Knowledge of Markets, the Key to Industrial Planning
Rochester	Nov. 10	Powers Hotel	O. E. Harder	Precision Metals
Rocky Mountain	Nov. 21	Oxford Hotel, Denver	H. A. Ellis	Magnesium
Pueblo Group	Nov. 20	Minnequa University Club	H. A. Ellis	Magnesium
Rome	Nov. 6			Charter Presentation Night
Saginaw Valley	Nov. 11	Fischer's, Frankenmuth, Mich.	R. W. E. Leiter	Deep Drawing of Sheet and Strip Steel
St. Louis	Nov. 21	York Hotel		New Developments in Experimental Steelmaking
Southern Tier	Nov. 10	Hotel Frederick, Endicott, N. Y.	R. H. Joerres	Practical Use of Springs
Springfield	Nov. 17	Hotel Sheraton	R. R. Tatnall	Wire—Its Fabrication and Heat Treatment
Syracuse	Nov. 5	Onondaga Hotel	Francis B. Foley	Alloys for Elevated Temperature Service
Terre Haute	Nov. 10	Indiana State	A. S. Rakestraw	Grinding and Other Abrasive Applications
Toledo Group	Nov. 20		J. A. Grodrian	Weldability and Metallurgy of Welding
Tulsa	Nov. 11	Spartan Cafeteria	E. G. Hill	Basic Openhearth
Washington	Nov. 10	Garden House, Dodge Hotel	O. J. Horger	Metallurgy and Design
Wichita	Nov. 20		H. K. Ihrig	Manufacture and Application of Seamless Tubing
Worcester	Nov. 12	Sanford Riley Hall, Worcester Tech	Ralph Leo	Steel Wire Vs. Cold Heading
York	Nov. 12	Steelton	Elliott Reid	Alloy Steels in the Openhearth

mechanism of fracture in terms of the flow and fracture strength concepts. 271 ref. Part II discusses recent work and states three new problems of importance in determining the fracture behavior of metals. 52 ref.

24-280. Brittle Lacquer Technique. Herbert Dobkin. *Steel*, v. 121, Sept. 1, 1947, p. 70-71, 98-99.

Tests prove value of applying experimental methods to aid in solution of complicated analytical problems involving parts subjected to extremely high centrifugal stresses.

24-281. The High-Pressure Gasholder. M. Noone and A. G. Grant. *Gas Journal*, v. 251, Aug. 13, 1947, p. 364-366.

Design principles, especially for welded construction, and pressure-test procedures. (To be continued.)

24-282. Orientation of Strain Gages in Stress Analysis. A. W. Rankin. *General Electric Review*, v. 50, Sept. 1947, p. 14-21.

The basic laws of stress and strain in a condensed form, with particular emphasis on the laws of strain. How to use these basic laws to show how strain gages should be applied, in number and orientation, so that the strain at a given point can be determined completely. How to combine the strain values so obtained.

24-283. A New Fatigue Strength Damping Criterion for the Design of Resonant Members. Joseph Marin and F. B. Stulen. *Journal of Applied Mechanics*, v. 14 (*Transactions of the A.S.M.E.*, v. 69), Sept. 1947, p. A209-A212.

A theoretical analysis shows that the load resistance of resonant members is a function not only of the fatigue strength but also of the damping constant and modulus of elasticity of the material. Test data on various materials show that the load resistance of a vibrating member may be appreciably changed by a correct selection of the material when this new design criterion is used. Data for vibrating beams and plates subjected to both concentrated and distributed resonant forces; other applications.

24-284. Making the Most of Pressed Metal in Design. *Electrical Manufacturing*, v. 40, Sept. 1947, p. 94-97, 156.

Possibilities in the replacement of machined castings are illustrated by descriptions of the fabrication procedures and illustrations of a number of pressed metal products.

24-285. Brittle Lacquer Stress Analysis. Part II. E. Barber. *Engineering Materials and Processes*, v. 5, Aug. 1947, p. 87-89.

Concluded.

24-286. Modern Engineering Stress Analysis. *Engineering Materials and Processes*, v. 5, Aug. 1947, p. 94-97.

Use of the polariscope.

24-287. Photo-Elastic Stress Analysis. *Steel*, v. 121, Sept. 8, 1947, p. 84, 86.

Use in British gear works.

24-288. Sound Engine Design Thwarts Parts Fatigue. *SAE Journal*, v. 55, Sept. 1947, p. 44-45.

Design changes in airplane engine parts to provide proper geometry, thus reducing stress concentration. Improper machining also may result in fatigue failure. (Based on "Endurance—A Criterion of Design", by W. T. Bean, Jr.)

24-289. Jig and Fixture Designs. Robert Mawson. *Tool & Die Journal*, v. 13, Sept. 1947, p. 80-82.

A multiple type drilling jig; milling fixture for a locking lever.

24-290. Refrigerator Door Tool Design Simplified. G. M. Bleakley. *American Machinist*, v. 91, July 31, 1947, p. 88.

Simplified design method; using an approximate arithmetical formula for calculating dished surfaces.

24-291. Prefabricated Shapes for Magnesium Truck Bodies. *Automotive Industries*, v. 97, Sept. 15, 1947, p. 31.

Design drawings and description.

24-292. Design Considerations for Carbide Sheet Metal Dies. Earle Glen. *Steel*, v. 121, Sept. 22, 1947, p. 75-76, 109.

Prime construction features of various blanking and progressive dies and of blanking punches.

24-293. Pattern for a Tapering Tee. O. W. Kothe. *Sheet Metal Worker*, v. 38, July 1947, p. 49-50.

Diagrams for application of a tapering tee to a cylindrical pipe with elbow part of tee facing in a diagonal direction.

24-294. Determination of Thickness of Unfired Steel Pressure Vessels. Coleman J. Major. *Chemical Industries*, v. 61, July 1947, p. 106, 108, 110.

Nomographs for determining safe thicknesses, in accordance with the 1946 A.S.M.E. Code, for cylindrical shells and seamless dished heads.

24-295. Design of Flanged Joints. S. Labrow. *Institution of Mechanical Engineers Proceedings*, v. 156, no. 1, 1947, p. 66-70; discussion, p. 70-73.

Basis of design adopted by one firm to insure consistency over a wide range of pressures and sizes. Table on gasket factors and yield values for various materials including metals, asbestos, rubbers, and fabrics, and one on effective gasket width.

24-296. The Bending Strength of Materials With a Nonlinear Stress-Strain Curve. S. S. Gill. *Aircraft Engineering*, v. 19, July 1947, p. 212-216.

A number of curves for finding the position of the neutral axis and the failing bending moment.

24-297. Elastic and Plastic Bending of Beams. Tsun Kuei Wang. *Journal of the Aeronautical Sciences*, v. 14, July 1947, p. 422-432.

A method for analyzing fiber stresses of beams which includes the full effect of nonlinear stress-strain characteristics of materials throughout the elastic and plastic range. Various shaped cross sections commonly encountered in aircraft practices. 10 ref.

24-298. Some Common Developments Simplified: Labor-Saving Formulas for Cylindrical Pipe Subjects. J. B. Clegg. *Sheet Metal Industries*, v. 24, Sept. 1947, p. 1836-1839.

Layout of simple elbows, segment elbows, roof plate apertures, and ellipses.

For additional annotations indexed in other sections, see:
5-62; **20**-491-530; **22**-444-527-533; **27**-169-176-195-204-209-212-216.

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Progressive Welder Co. Detroit 12, Mich.

25 MISCELLANEOUS

25-117. Compte Rendu des Travaux Presentes a la Reunion d'Automne de la Societe Francaise de Metallurgie. (Report on Work Presented at the Autumn Meeting of French Society for Metallurgy—October 22 to 24, 1946.) Paul Lacombe. *Revue de Metallurgie*, v. 43, Sept-Oct. 1946, p. 240-252.

The trend toward studies of the physics of metals—changes in crystal structure as a result of mechanical treatment—as well as the constant attempt to improve the quality of metals.

25-118. The British Iron and Steel Industry Increasing Facilities for Production, Research and Development. *Metallurgia*, v. 36, July 1947, p. 133-136, 160.

Some of the steps taken to increase production facilities and to exploit scientific knowledge.

25-119. Metallurgical Research in Germany Since the War. M. Hansen. *Journal of the Iron and Steel Institute*, v. 156, July 1947, p. 370.

Institutes in Germany that are able to work normally; the work under way.

25-120. The Iron and Steel Institute Meeting in Switzerland. *Engineering*, v. 164, July 18, 1947, p. 67-68.

Reviews of papers presented. (To be continued.)

25-121. Steel Research Helps Meet Needs of Industry. Charles M. Parker. *Materials & Methods*, v. 26, Aug. 1947, p. 65-70.

Development of free-machining stainless steel.

25-122. Handling in the Flow of Production Welding. A. E. Rylander. *Industry and Welding*, v. 20, Aug. 1947, p. 38-39, 58, 60-64.

How rotary conveyer and other simple fixtures aid continuous flow of materials, ease of operation and very high production potential.

25-123. Visual Layout Previews Production. Harry S. Wharen. *American Machinist*, v. 91, Aug. 14, 1947, p. 113-116.

Application of three-dimensional layouts to the planning of assembly-line and plant layout at Ford Motor Co.

25-124. Machinery on Rubber. *Western Metals*, v. 5, Aug. 1947, p. 19-21.

Application and advantages of rubber in metalworking plants.

25-125. Rubber Mountings in Industry. *Western Machinery and Steel World*, v. 38, Aug. 1947, p. 77-79, 111.

The application of the comparatively new art of vibration, noise and impact insulation. Rubber compounds having known useful and predictable engineering properties have been especially developed for these applications. Properties and advantages for carbide dies.

25-126. From Sheet Steel to Scrap—by Crane. George H. Johnson. *Flow*, v. 2, Aug. 1947, p. 24, 26, 66-67.

Crane handling of sheet steel. The same crane also serves the scrap disposal system, handling specially designed large-capacity buckets in temporary storage and car loading. Positioning of sheared stock by use of hydraulic lifting cylinders.

25-127. High Volume Production Aided by Suspended Assembly. Frank M. Scotten. *Production Engineering & Management*, v. 20, Aug. 1947, p. 73-76.

Materials handling on assembly line of Fisher Body Div., General Motors Corp.

25-128. Utilizing Mechanized Handling to Speed Maintenance. T. A. Lewis. *Factory Management and Maintenance*, v. 105, Aug. 1947, p. 110-112.

Materials-handling equipment and procedures at Bethlehem Steel.

25-129. Handling Materials for Steelmaking. Charles M. Parker. *Industrial Heating*, v. 14, Aug. 1947, p. 1296, 1298, 1300.

Materials handling equipment for all phases of steelmaking operations, from the mining of the iron ore to the shipment of the finished products.

25-130. Steam Turbines for Iron and Steel Works. I. V. Robinson. *Blast Furnace and Steel Plant*, v. 35, Aug. 1947, p. 980-982, 1000-1001.

Blower turbines, power turbines, and geared turbines; their operation and application.

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NATIONAL MEETINGS

Oct. 29—American Iron and Steel Institute. Regional Technical Meeting, Bellevue-Stratford Hotel, Philadelphia. (The Institute, 350 Fifth Ave., New York 1.)

Nov. 5—American Iron and Steel Institute. Regional Technical Meeting, William Penn Hotel, Pittsburgh. (The Institute, 350 Fifth Ave., New York 1, N. Y.)

Nov. 6-8—Meehanite Metal Corp. Annual Convention of Manufacturers of Meehanite Castings. Hotel Carter, Cleveland. (Meehanite Metal Corp., 800 Pershing Square Bldg., New Rochelle, N. Y.)

Nov. 7-8—Pittsburgh Conference on X-Ray and Electron Diffraction. Fifth Annual Meeting, Mellon Institute, Pittsburgh. (Harold Klug, General Chairman, Mellon Institute of Industrial Research, 4400 Fifth Ave., Pittsburgh.)

Nov. 14—American Iron and Steel Institute. Regional Technical Meeting, Stevens Hotel, Chicago. (The Institute, 350 Fifth Ave., New York 1.)

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POSITIONS OPEN

East

RESEARCH PHYSICAL METALLURGIST: For longterm fundamental study in nonferrous field. Work involves relatively new and little-explored regions. Position requires that individual have good fundamental and theoretical bacl ground combined with good experimental aptitude. Location southern New England. Box 10-5.

JUNIOR METALLURGIST: With training in welding. Position provides training in mill processes and research development in addition to welding. Starting salary of $220 with increase after 90 days. Box 10-10.

ASSISTANT METALLURGIST: To work in precision casting plant. Shop man rather than research man desired. Must have exp. in casting field and preferably in precision casting. Salary depends on exp. and qualifications. Box 10-15.

RESEARCH METALLURGIST: With some exp. in alloy steels, to work in research lab. of a large manufacturer of complete range of alloy steels. State age, martial status, education, exp. and salary expected. Box 10-20.

MECHANICAL OR METALLURGICAL ENGINEER: For opening in met. lab. in the East. College grad. with 1 to 5 yr. exp. While both mech. and met. training and exp. are desired, applicant with but one of the above may be considered. Please submit qualifications and minimum salary desired. Box 10-25.

METALLURGIST: With practical furnace exp., and complete knowledge of ferrous raw materials. Position is with a chemical co. and entails the assignment of improving quality of cinders resulting from a roasting process and putting them into marketable form. Box 10-30.

FURNACE ERECTION SUPERINTENDENT: Exp. in all types of heat treating furnaces. Exp. men for estimating and designing furnaces and ovens. W. S. Rockwell Co., 200 Eliot Street, Fairfield, Conn.

South

YOUNG MEN: Large firm located in the South with rolling mill equipment needs additional college trained men—recent graduates and men with 2 to 5 yr. exp. Openings for men with degrees in business administration, mechanical, electrical, industrial and metallurgical fields. Co. is national and international in scope, but neither too large to retard advancement nor too small to provide proper advancement for recognized ability. Personal interview will be arranged. Box 10-35.

Midwest

RESEARCH METALLURGIST: Young men with good academic records and interest in research in any phase of met. are invited to consider employment possibilities in the attractive Battelle research laboratories. Opportunities for professional growth, individual initiative, and advancement are limited only by the capabilities of the individual. All inquiries promptly acknowledged and treated confidentially. Please address replies directly to Battelle Memorial Institute, 505 King Ave., Columbus 1, Ohio.

STATISTICAL QUALITY CONTROL: Man with mech. eng. degree and 2 or 3 yr. industrial exp. to help establish a statistical quality control program. Previous exp. in specific field not required. Duties include installation of technique, presenting results of analysis to mfg. supervision and assisting in determination of causes of defects. Must understand engineering drawings. Box 10-40.

FOUNDRY FOREMAN: For aluminum and magnesium casting. Must be thoroughly familiar with production methods. Box 10-45.

METALLURGICAL ENGINEER: Interested n met. development of nonferrous alloys. Exp. in refractory metals helpful but not essential. Prefer man having M.S. degree and 3 to 5 yr. exp. in plant or development work. In reply give detailed description of previous exp., personal history and salary expected. Box 10-50.

SENIOR METALLURGIST: Ph.D. or equivalent, to organize and supervise research program in high temperature materials. SENIOR PHYSICAL METALLURGIST: Ph.D. or equivalent, for research in X-ray diffraction studies of materials at elevated temperatures. NUCLEAR CHEMIST: Ph.D. or equivalent, for nuclear and radiochemical studies. SPECTROSCOPIST: Ph.D. or equivalent, or research and management of spectrographic service laboratory within the research division. CHEMIST AND METALLURGIST: With knowledge of ceramics, to prepare reports and abstract current literature in the research division. Knowledge of German preferred but not essential. PHYSICAL CHEMISTS AND PHYSICISTS: Ph.D. or equivalent, for elevated temperature studies of materials. If interested in any of the above, please furnish resume giving personal, educational and experience data to N.E.P.A. Div., Fairchild Engine and Airplane Corp., P.O. Box 415, Oak Ridge, Tenn.

CONSULTANT METALLURGIST: With management exp., age 35 to 45, to take charge of commercial heat treating plant in Cleveland district. Salary and commission open. Box 10-135.

POSITIONS WANTED

CHEMICAL ENGINEER—METALLURGIST: 24 yr. highly diversified exp. in mfg. industries. Specialized metals—fabrication, heat treating, finishing, plating—as well as wood, rubber, plastics, leather, textiles. Materials and process engineering, research, development, control, testing, analysis. Chem. operations supervisor, chief inspector. Now employed, but desires position of greater responsibility with commensurate salary. New England preferred. Box 10-55.

METALLURGICAL SALES ENGINEER: B.S. degree. 12 yr. exp. including sales promotion and metallurgical supervisor of complaint investigations. Well qualified in metallurgical principles through 8 yr. fundamental training in research dept. of steel and brass mills. Desires position as technical supervisor in sales. Age 35. Box 10-60.

ROLLING MILL SUPERINTENDENT: With good background in processing and cold rolling of both ferrous and nonferrous strip metals. Foreign exp. includes starting into operation a complete wide cold strip rolling mill. Box 10-65.

METALLURGIST: B.A. 1940; B.S. in met. eng. 1947. Age 29, single, Navy veteran. 2 yr. exp. as metallographer in automotive research and development lab. 1 yr. as fdry. chemist. Desires position as heat treating met.-or process control eng., either fdry. or forge shop. Box 10-70.

GRADUATE METALLURGIST: Excellent background. 8 yr. exp. in development, research, heat treating and teaching. Good knowledge of wrought and cast steels, constructional, stainless and toolsteels, cast irons, powdered metals. Desires position as plant, research or sales metallurgist with progressive firm in ferrous physical met. field. Box 10-75.

REGISTERED PROFESSIONAL ENGINEER (ILLINOIS): Desires connection with progressive corp. or small well financed organization in need of excellent mechanical or electrical engineer. Thoroughly familiar with mass production methods, tools, dies, all machines. Can take charge of plant. Will consider any position from general manager down to tool or project engineer. Will really produce results. Salary open. Age 47, 33 yr. exp. Box 10-80.

METALLURGICAL ENGINEER: Age 27, married, veteran. Met. eng. degree. 2½ yr. production met. and material acceptance. 1 yr. annealing research, physical testing and metallography. Interested in joining medium sized or small co. Box 10-85.

METALLURGIST: Ferrous. 19 yr. exp. a chemist and metallurgist in large automobile plant: Exp. as supervisor of heat treating, metallographi and testing lab. Competent metallographer. Extensive investigations of auto parts failures. Familiar with all phases of heat treating. Desires responsibl position in production lab. Box 10-90.

AUTOMOTIVE ENGINEER: Chem. mech. and met. grad. Currently dept. head charged with originating all new vehicle specifications, technical and statistical data, and analytical design. Previously automotive research eng., project eng., senior met. eng. (aircraft), chief metallurgist and chemist of stamping co. Desires chief or asst. chief eng. post or equivalently responsible position with progressive organization offering stability and individual opportunity. Box 10-95.

ENGINEER: Desires permanent position as met. trouble shooter or processing eng. B.S. in met. eng. with teaching exp. in physical met. and metallography, 2 yr. general lab. exp., 2 yr. design, 5 yr. large job shop trouble shooting. Box 10-100.

ENGINEER: With sales, sales eng., and production exp. in the steel and aluminum fields desires position in sales eng. or in production field. Good ref. Salary desired $350 per month. Box 10-105.

EXECUTIVE ENGINEER: Met. eng. degree. Over 20 yr. exp. in steel mill, fdry., industrial furnace design and operation. Thorough knowledge of modern methods of mfg. Customer contact work and sales. Best ref. Box 10-110.

METALLURGICAL ENGINEER. B.S. in met. eng. from Purdue. Age 28, married. 2 yr. exp. in development and product improvement eng. for large eastern co. 3 yr. exp. in Army ordnance development. Desires position in research, development, or product improvement. Any location in U. S. acceptable. Box 10-115.

TECHNICAL SERVICE REPRESENTATION OR PLANT METALLURGIST: B.S.M.E., age 30. 3½ yr. exp. in supervision of modern eng. met. lab. Selection, control and heat treatment of ferrous materials for automotive standard equipment concern. Can work with production dept. on problems of machinability, tool life, design and methods processing changes. Location immaterial. Box 10-120.

POWDER METAL EXPERT: Exp. in basic research, production and tool knowledge from A to Z. 12 yr. extensive shop and lab. exp. in powder met. Capable of starting powder metal parts plant or department. Box 10-125.

METALLURGIST: 51, married. B.S. degree. Many yr. exp. in steel mills and with an iron fdry. group on cooperative work. Exp. has been in lab., mill and customer relations and service. Box 10-130.

25-131. Radioactive Tracers in Metallurgical Research. E. S. Kopecki. *Iron Age*, v. 160, Sept. 4, 1947, p. 60-64.

Research program under way at Carnegie Institute of Technology is one of the first large-scale uses of radioactive tracers in metallurgy by a university laboratory. An intensive study of rates of diffusion is being made.

25-132. Power, Fuel and Steam Balances for a Modern Steel Plant. *Iron and Steel Engineer*, v. 24, Aug. 1947, p. 35-43; discussion, p. 44-45.

Contains the following papers: Relation of the steel plant to its electrical power load, by A. D. Howry. Relation of the power load to the steam and fuel balances, by Howard L. Halstead.

25-133. Flexibility of Chassis Assembly Widened by Suspended Conveying System. Jervis C. Webb. *Steel*, v. 121, Sept. 8, 1947, p. 72-74, 112, 115-116, 118.

Two overhead trolley conveyers—one a powered unit running over the other—team up to overcome a mass of small and major handling problems in Chevrolet's new plant.

25-134. Smears of Titanium Metal. W. A. Wooster. *Nature*, v. 160, Aug. 23, 1947, p. 260.

When metallic titanium is rubbed against many hard surfaces, metal is left behind in the form of a silvery smear, which may be removed by acid treatment. Some surfaces (for instance, glass) lose their polish when treated in this way. Practical applications are: coating materials with a metallic layer; etching glass without HF; and forming resistances of the order of 10^{11} ohms.

25-135. Super Metals Are on Way for Turbo-Jets, Rockets, Battelle Chief Declares. *Iron Age*, v. 160, Sept. 11, 1947, p. 240, 246, 250, 252.

Excerpts from talk by Clyde E. Williams before Salt Lake City meeting of A.S.M.E. and A.I.M.E.

25-136. Visits to Works. *Iron and Steel*, v. 20, Aug. 1947, p. 410-414.

A number of Swiss firms visited during meeting of British Iron and Steel Institute.

25-137. Molybdenum—Practical Structural Material. John Gelok. *Westinghouse Engineer*, v. 7, Sept. 1947, p. 156-159.

Production, properties, applications, and future possibilities.

25-138. Tin Plate Transportation. *Steel*, v. 121, Sept. 15, 1947, p. 106, 109.

Materials-handling procedures in the tin-plate department of Carnegie-Illinois Steel Corp.'s Irvin Works.

25-139. High-Volume Scrap Metal Loading. *Flow*, v. 2, Sept. 1947, p. 22-23.

Materials-handling equipment and procedures at a scrap yard.

25-140. Drop Disposal for Forgings. *Flow*, v. 2, Sept. 1947, p. 36-38.

Drop disposal for forgings, plus better machine lay-out, has increased man-efficiency and productive hours 6%. Use of cab-controlled hoisting units on I-beam trackage in a narrow storage area.

25-141. Conveyer-Belt Operation. M. C. Dow. *Mining Technology*, v. 2, July 1947, T. P. 2212, 9 p.

Suggestions for improvement in the operation of conveying belts, based on many years experience with belts in crushing plants.

25-142. A Year of Radio-Isotopes. *Chemical and Engineering News*, v. 25, Aug. 4, 1947, p. 2202.

Atomic Energy Commission reviews the work that has been accomplished with these tools and outlines the shape of things to come.

25-143. Latest Body Assembly Techniques by Fisher. Joseph Geschelin. *Automotive Industries*, v. 97, Sept. 15, 1947, p. 28-30, 64.

Automobile underbody, front end and balloon assembly; painting procedure; welding.

25-144. Complete Car Bodies Built on Big Bertha Conveyer. *Automotive Industries*, v. 97, Sept. 15, 1947, p. 32-33.

Conveyer system at Briggs plant. Merry-go-round setup expedites assembly and welding operations on floor pans.

25-145. The Iron and Steel Institute Summer Meeting Held in Switzerland. *Metallurgia*, v. 36, Aug. 1947, p. 183-192.

Abstracts of papers and accompanying discussion.

25-146. Paint Finishing Ovens Installed on Plant Roof to Increase Production Space. *Industrial Heating*, v. 14, Sept. 1947, p. 1491-1492, 1494, 1496.

Expedient adopted by Cavalier Corp., Chattanooga, Tenn.

26 STATISTICS

26-126. Molybdenum. Edwin K. Jenckes. *Bureau of Mines Minerals Yearbook Preprint*, 1946, 8. p.

A review. 25 ref.

26-127. Cobalt. Hubert W. Daves. *Bureau of Mines Minerals Yearbook Preprint*, 1946, 9 p.

A review. 11 ref.

26-128. The Swiss Metal and Engineering Industries. W. M. Von Orelli. *British Steelmaker*, v. 13, Aug. 1947, p. 408-420.

A review of Swiss industrial development in the last century. Statistics show the percentages of persons employed in the various occupations.

26-129. Iron Ore Supply for the Future. George W. Hewitt. *Blast Furnace and Steel Plant*, v. 35, Aug. 1947, p. 957-963.

Tables for production and consumption, both domestic and foreign; future requirements.

26-130. The Nonferrous Foundry Industry—Its Structure, Sales, Costs and Profits. Joseph B. Meier and Virginia H. McClung. *Foundry*, v. 75, Sept. 1947, p. 94-96, 216, 218, 220, 222, 224, 226, 228, 230, 232.

OPA statistics for nonferrous foundry cost and profit ratios during 1940-1946. (Concluded.)

26-131. American Machinist Survey Reveals 643 Metalworking Companies Will Spend $94,984,750 for New Production Equipment Between Now and the End of 1948. *American Machinist*, v. 91, Sept. 11, 1947, p. 173-185.

Graphs and tables give answers to the following questions: How many and what kind of machine tools will be bought? Who will supply the tooling? How much carbide tooling will be used? What operating features will be specified on new machine tools? What forming and forging equipment will be bought? What materials-handling equipment will be bought? How much air-conditioning will be installed? What heat treating, welding and metal-finishing equipment is to be bought? What officials buy production equipment? How the survey was made.

26-132. The Iron Ores of Germany. A. E. Lance. *Journal of the Iron and Steel Institute*, v. 156, Aug. 1947, p. 449-476.

The iron-ore deposits in Germany; the different types of ore mined; mining methods used.

26-133. Iron Ore Supplies. Rupert Jackson. *Iron and Steel*, v. 20, Aug. 1947, p. 415.

Developments in Labrador.

26-134. Steel Development Plan. Part III—Progress of the Plan. R. W. Shone. *Iron and Steel*, v. 20, Aug. 1947, p. 416-418.

Description of British plan. (Concluded.)

26-135. Steel Shortage Seen Ended by 1949. *Steel*, v. 121, Sept. 22, 1947, p. 46-47.

Testimony of the country's leading steel executives before the Steel Subcommittee of the Senate Small Business Committee in Washington, Sept. 12.

26-136. Solution of the Problem of the Kursk Magnetic Anomaly. V. Rikman. *Metallurgia*, v. 36, Aug. 1947, p. 201-202.

Discovery, development, and future plans for utilization of a magnetic iron-ore deposit in the Kursk district of the U.S.S.R. Reserves of rich ores containing up to 70% Fe and capable of being smelted without previous concentration are estimated to exceed 340 million tons.

26-137. The Status of Raw Materials Problems in the Steel Industry. *Industrial Heating*, v. 14, Sept. 1947, p. 1462, 1464, 1466.

Summary of six papers and accompanying discussion at recent annual meeting of American Iron and Steel Institute in New York.

For additional annotations indexed in other sections, see:
27-184-196.

27 NEW BOOKS

27-168. Transactions of the American Institute of Mining and Metallurgical Engineers; Institute of Metals Division. V. 166, 622 p. 1946. The Institute, 29 West 39th St., New York 18, N. Y.

Contains papers presented before meetings of the society and previously published in *Metals Technology* in 1945 and 1946.

27-169. Proceedings of the Society for Experimental Stress Analysis. V. 4, No. 2. C. Lipson and W. M. Murray, Editors. 121 p. 1947. Addison-Wesley Press, Inc., Cambridge 42, Mass. $5.00.

Fatigue Tests of Major Aircraft Structural Components, by W. G. Pierpont. Precision Determination of Stress-Strain Curves in the Plastic Range, by John R. Low. A Method of Detecting Incipient Fatigue Failure, by Henry W. Foster. A Machine for Fatigue Testing Full-Size Parts, by A. F. Underwood and C. B. Griffin. Some Repeated Load Investigations on Aircraft Components, by S. A. Gordon. Stress Analysis Utilization in Dynamic Testing, by Roy W. Brown. Device for Maintaining Continuous Electrical Connections With Reciprocating Engine Parts, by W. A. Wallace and W. A. Casler. Evaluation of Various Methods of Rotor-Blade Analysis by Means of a Structural Model, by Robert Mayne. Reluctance Gages for Telemetering Strain Data, by W. H. Pickering. The Linear Variable Differential Transformer, by Herman Schaevitz. Design and Application of Accelerometers, by David E. Weiss. Aircraft Instruments for Radio-Telemetering and Television-Telemetering, by Carl L. Frederick.

27-170. Electronic Methods of Inspection of Metals. 189 p. 1947. American Society for Metals, Cleveland, Ohio. $3.50.

Seven educational lectures: Electronic Methods for the Measurement of Strain in Metals, by H. F. Hamburg. Spectrochemical Analysis of Metals and Alloys by Direct Intensity Measurement Methods, by J. L. Saunderson. Uses of the DuMont Cy-

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Editorial Feature for December—

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Instruments for processs control . . . for temperature control . . . for temperature indication and measurement . . . these will be featured in the December issue of Metals Review.

Developments in this field, both published and product, will be covered in two comprehensive articles.

AN INVITATION

If you have a product that ties into this industry . . . a product that is new, improved or re-designed during the past twelve months, we would like to review it in this issue.

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All material should be in our hands by November 15, 1947.

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elograph for Testing of Metals, by R. S. Segsworth. Supersonic Methods of Metal Inspection, by E. O. Dixon. Determination of Seams in Steel by Magnetic Analysis Equipment, by Charles M. Lichy. The Electron Microscope and Its Application to Metals, by Charles S. Barrett. Electronics in Liquid Steel, by Harold T. Clark.

27-171. The Examination of Arc Welds in the Shipyard. 29 p. His Majesty's Stationery Office, London, England. 1s.

Recommendations by the admiralty ship-welding committee for the guidance of shipbuilders, designers, and inspectors.

27-172. British Iron and Steel Directory. 224 p. The Metal Bulletin, London, England. 5s.

An up-to-date guide to British producers and suppliers of all kinds of iron and steel. The classified section lists a wide range of products and their suppliers, while an alphabetical section gives full addresses, telephone numbers, and telegraphic addresses.

27-173. An Introduction to the Electron Theory of Metals. G. V. Raynor. 98 p. 1947. The Institute of Metals, Grosvenor Gardens, London, S.W.1, England, 6s, 3d.

Written primarily for the older metallurgist who is unfamiliar with the approach of the physicist to metallurgical problems. It attempts to interpret, as far as possible non-mathematically, some of these concepts. It does not claim to give full and complete knowledge of the subject.

27-174. Notes on Gage Making and Measuring. Edition 2. 73 p. National Physical Laboratory, Metrology Dept., His Majesty's Stationery Office, London, England. 2s.

Much unique information and data on diamond tools for truing grinding wheels on surface grinders for gage grinding. The second edition seems to be practically identical with the first, with the exception of a few added illustrations and an appendix of tables for use in taper measurements.

27-175. Cutting Tools for Metal Machining. M. Kurrein and F. C. Lea. 312 p. 1947. Charles Griffin & Co., Ltd., London, England. 28s.

Data and comparison on British, Continental, and American practice. Deals in great detail with the process of finish turning by sintered carbide and diamond tools. Two comprehensive tables give ordinary service data for turning and boring with diamond tools.

27-176. Steel Construction: A Manual for Architects, Engineers and Fabricators of Buildings and Other Steel Structures. Edition 5. 432 p. 1947. American Institute of Steel Construction, 101 Park Ave., New York, N. Y. $2.00.

Data most frequently referred to by structural estimators and designers; the data required in making shop drawings; tables of allowable loads; standard specifications and codes; and miscellaneous data and mathematical tables for ready reference.

27-177. Igneous Minerals and Rocks. Ernest E. Wahlstrom. 367 p. John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. $5.50.

Igneous rock-making minerals including their optical examination and supplementary methods for their determination. The chemical composition of each mineral together with special chemical tests and physical properties. Mineral habits and associations. Mineral identification. Part II deals with the igneous rocks, their structure, texture, color, alternations, and chemical composition.

27-178. Workshop Calculations for Machine Tool Operators. G. Williams. 170 p. Sir Isaac Pitman and Sons, Ltd., Parker St., Kingsway, London, W.C.2, England. 10s, 6d.

Midway between the practical and purely academic, this book aims to bridge the gap between classroom teaching and application in toolroom or workshop. Analysis of workshop practices and the mathematics involved. The theory of change-speed gears; taper turning, screw threads, and indexing and spiral milling; spur, spiral, bevel, and worm gears in theory and practice; miscellaneous workshop operations; and the systems of fits and tolerances in common use.

27-179. Watkins Cyclopedia of the Steel Industry. Edition 1. 468 p. 1947. Steel Publications, Inc., 108 Smithfield Street, Pittsburgh 30, Pa. $10.00.

A.I.S.I. statistics and articles on coking and coke ovens, iron-ore beneficiation, nodulizing, sintering and smelting, steel-melting processes, rolling and shaping, steel plant refractories, carbon and alloy steels, fabrication, welding, cleaning and finishing, inspection and testing, steel processing furnaces, materials handling.

27-180. Milling With Carbides. 41 p. Metal Cutting Tool Institute, 6400 Chrysler Bldg., New York 17, N. Y. $1.00.

General considerations including cost factors; data on the characteristics of various grades and brands of carbide. Requirements for machine tools and fixtures; nomenclature for milling cutters; factors involved in cutter design; speeds and feeds.

27-181. Heat Treatment of Aluminum Alloys. 31 p. Aluminum Company of Canada, Ltd., Montreal, Canada. Gratis.

Booklet prepared to assist the users of aluminum alloys in solving their heat treating problems begins with a simple explanation of fundamental theory.

27-182. Infrasizer. 43 p. 1946. Infrasizer's Limited, Toronto, Canada.

A laboratory instrument for splitting subsieve size particles into seven products, based on the settling rates of the particles in air, using six cones in series. Details of development, the results obtainable with it, and limitations.

27-183. Turbimetric Particle Size Analysis. J. R. Musgrave and H. R. Harner. 47 p. 1947. Eagle-Picher Co., American Bldg., Cincinnati 1, Ohio.

Monograph gives a complete description of the methods used in Eagle-Picher's laboratories. 289 ref.

27-184. British Nonferrous Metals Research Association Twenty-Seventh Annual Report. 43 p. British Nonferrous Metals Research Association, Euston St., London, N.W.1, England.

A review of research progress for the past year.

27-185. D.S.I.R.—A Description of the Work of the Department of Scientific and Industrial Research. 31 p. 1946. Department of Scientific and Industrial Research, Park House, 24 Rutland Gate, South Kensington, London, S.W.7, England.

Organization, facilities, and programs of British Government research.

27-186. Digest of Steels for High Temperature Service. Edition 5. 215 p. 1946. The Timken Roller Bearing Co., Steel and Tube Div., Canton 6, Ohio.

Complete high temperature data on 22 steels which have found general use in many different types of applications. Important physical properties compared.

27-187. Bituminous Coatings for the Protection of Iron and Steel Against Corrosion. R. St. J. Preston. 39 p. 1946. His Majesty's Stationery Office, London, Department of Scientific and Industrial Research, London, England.

Bituminous coatings are classified in respect to their media and pigments and their value for the protection of iron and steel against corrosion, particularly under immersed conditions. A survey of compositions used for protection against fouling by marine organisms. 256 ref.

27-188. Spectroscopy of Lead Oxides for the Storage Battery Industry. E. J. Dunn, Jr., and A. J. Mitteldorf. 24 p. 1947. National Lead Co. Research Laboratories, Brooklyn, New York.

The principle of the spectrochemical method, based upon a d.c. arc procedure. The techniques were established by a study of the fundamental aspects of burning the dried salt standards under varying conditions in the ultraviolet and visible ranges of the spectrum. A device for automatically centering the carbon electrodes in the Petrey stand.

27-189. Frozen Motion or Chip Contours as a Clue to the Mechanisms of Metal Cutting. William H. Oldacre and Harry A. Erickson. 11 p. June 1947. D. A. Stuart Oil Co., Ltd., 2727 S. Troy St., Chicago 23, Ill.

Preliminary work indicates that much can be learned concerning the mechanism of metal cutting from a careful study of chip shape and microstructure. Chips produced by six different cutting speeds reveal a striking gradation in shape, from a small tight spiral at the lowest speed to an almost straight chip at 536 r.p.m.

27-190. Dynamic and Static Compression Testing of ⅜-in. Copper Balls. (Report R-240.) D. E. Abkowitz. 22 p. July 1947. Navy Department, David Taylor Model Basin, Washington 25, D. C.

Copper balls, for use in ball-crusher gages, were calibrated statically and dynamically to investigate the relationship of speed effect to deformation. The falling-weight apparatus used in the dynamic calibrations, and the results in energy-deformation curves.

27-191. Machine Production 1947, Burgess Directory. 164 p. 1947. Monetary Times Printing Co. of Canada, Ltd., 341 Church St., Toronto 2, Canada.

Information on the Canadian and American tool and machine-tool markets. Alphabetical index of commodities; names and addresses of manufacturers and dealers; and a directory of dealers and distributors.

27-192. Bibliography on the Properties of Chromium-Nickel Stainless Steels; 1935-1945. 116 p. 1947. International Nickel Co., 67 Wall St., New York 7, N. Y.

Scope is limited to iron-base alloys containing 12 to 30% Cr and 6 to 30% Ni, with or without alloy additions. Corrosion properties have been omitted. The abstracts are arranged by year of publication and the headings by A.I.S.I. compositions; or, if nonstandard, the Cr and Ni contents and any alloy additions.

27-193. Properties of Frequently Used Carbon and Alloy Steels. Edition 3. (Booklet 211.) 131 p. 1946. Bethlehem Steel Co., Bethlehem, Pa.

Recommended heat treatments, hardenabilities, quenching media, magnetic inspection,, machinability, phase transformations, decarburization, and the properties of various steels.

27-194. Theory and Application of Radio-Frequency Heating. George H. Brown, Cyril N. Hoyler, and Rudolph A. Bierwirth. 370 p. 1947. D. Van Nostrand Co., Inc., 250 Fourth Ave., New York 3, N. Y. $6.50.

Fundamental principles treated thoroughly. Mathematics is used liberally, but graphical analysis aids in its clarification. Applications described, including annealing brass and bronze, paint baking, brazing, case hardening, wood gluing, dehydration, pasteurization, sterilization, and cooking.

(Turn to page 55)

27-195. Elements of Mechanism. Peter Schwamb, Allyne L. Merrill and Walter H. James. 428 p. 1947. John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. $3.75.

Application of the fundamental principles of kinematics in the field of mechanical movements. The more common and more fundamental machine elements are selected, and their motions when combined in certain definite ways studied.

27-196. Analyzes Lake Superior Iron Ores, Season 1946, With Other Statistical Tables and a Directory of Mine Operators. 51 p. 1947. The Lake Superior Iron Ore Assoc., 1170 Hanna Bldg., Cleveland, Ohio. Gratis.

Statistical data include mine shipments, shipments from lake ports and all-rail, furnace consumption and stocks.

27-197. Steel Plates and Their Fabrication. 408 p. Lukens Steel Co., 323 Lukens Bldg., Coatesville, Pa. $5.00.

Processes by which they are fabricated, and commercially standardized formed plates such as flanged and dished heads. A comprehensive analysis of the strength of plates subjected to a wide range of conditions of support and loading.

27-198. Verfahrens und Messkunde der Naturwissenschaft. Heft 3. Messmittel und Prufverfahren in der Mechanisch-technologischen Metallprufung. (Procedures and Measuring Techniques in Natural Science. Part III. Measuring Instruments and Test Methods for Mechanical-Technological Metal Testing.) Gunter Hahn. 102 p. Friedrich Vieweg & Sohn, Braunschweig, Germany. (Republished 1946 by J. W. Edwards, Ann Arbor, Mich.)

The various methods for determining the mechanical properties of metals. 40 ref.

27-199. Induction Heating. By "Heat-Treater". 147 p. Chapman and Hall, Ltd., 37 Essex St., London, England. 10s. 6d.

Induction heating and the rapid developments in the manufacture of the electronic type of high-frequency generator. Broad field of application.

27-200. An Introduction to Metallurgy. Joseph Newton. 645 p. John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. $5.50.

This second edition, largely rewritten and as modern as plutonium, is a masterpiece of condensation. Some accurate information is contained on almost any branch of the subject you might think of except pyrometry—omitted for an unstated reason, and hardly understandable except to an instructor in a western school in view of the 60 pages devoted to ore dressing. A curious inversion places "adaptive metallurgy" (from atoms to heat treatment) in the first half of the book and "extractive metallurgy" (from ores to electrolytic refinery) in the rear. Only a teacher of wide experience could say whether an encyclopedic book like this is a better text than one of equal bulk that gives a more detailed story about things of greatest engineering and economic importance and says practically nothing about a multitude of fascinating byproducts. E.E.T.

27-201. 1946 Book of A.S.T.M. Standards Including Tentatives. Part I-A. Ferrous Metals. 1181 p. **Part I-B. Nonferrous Metals.** 917 p. American Society for Testing Materials, 1916 Race St., Philadelphia, Pa. $8.00 for each part, for nonmembers.

Each part carries a detailed index and two tables of contents, one listed by general materials, the other by numerical sequence of designations.

27-202. Controlled Atmospheres in Heat Treatment. G. T. Dunkley. 69 p. Sir Isaac Pitman and Sons, Ltd., 39 Parker St., London, W.C.2., England. 7s. 6d.

Excellent introduction for plant technicians who wish to familiarize themselves with the underlying principles of the process. Physico-chemical aspects, various types of atmosphere and generating plant, and "bright" heat treatment operations.

27-203. The Metallization of Plastics. J. R. I. Hepburn. 71 p. Cleaver-Hume Press, Ltd., 42a South Audley St., London, W.1., England. 6s.

All the processes at present in use for depositing metals on plastics—solution treatment, metal spraying and cathode sputtering. Characteristics of the deposits formed and methods of testing them for defects.

27-204. A Practical Theory of Mechanisms. Paul Grodzinski. 166 p. Emmott & Co., Ltd., 21 King St. W., Manchester 3, England. 7s. 6d.

This pocket-sized volume is more of a handbook than a text, although it does start with fundamental concepts and explanations. Examples from the simplest linkages with their common inversions to the more complex types are given.

27-205. Rolling Bearings. R. K. Allan. Sir Isaac Pitman and Sons, Ltd., Parker St., Kingsway, London W.C.2, England. 30s.

The term "rolling bearings" is applied to ball and roller bearings of all types. A historical note on bearing development, then the elementary mechanics of the subject, friction, rolling elements, cages, track curvature, and contact areas. Fundamental equations deduced for various types of bearings. Materials and manufacturing processes. The researches of Hertz, Stribeck, and Goodman, with mathematical development of their respective theories, followed by practical application to specific types of bearings. Palmgren's work on the endurance of rolling bearings and the formulas relating to bearing life.

27-206. Hardenability of Alloy Steels. Society of Automotive Engineers, Inc., 29 W. 39th St., New York 18, N. Y. $2.00. Members $1.00.

Published jointly by S.A.E. and A.I.S.I., this book covers current data on designing, testing and ordering steels by hardenability-band specifications. Other sections discuss selection of automotive steels on the basis of hardenability and the S.A.E. method of determining hardenability. Conversion of steel hardness numbers.

27-207. Working With Aluminum. Douglas B. Hobbs. Bruce Publishing Co., 540 N. Milwaukee St., Milwaukee 1, Wis. $2.50.

Twenty-five projects involving basic metalworking processes. Processes correlated with the projects include coremaking, countersinking, drawing, etching, filing, finishing, hammering, machining, riveting, sawing, scroll forming, spinning, tapping, threading, and twisting.

27-208. Lessons in Arc Welding. Edition 3. 158 p. Lincoln Electric Co., 12818 Coit Rd., Cleveland, Ohio. $0.50.

A thorough revision of the previous editions with added feature of questions and answers section. Both a.c. and d.c. welding methods, new procedures covering large electrodes, and a number of lessons on pipe welding. The problem of distortion and its prevention and control.

27-209. Valve Gear Design. Michael C. Turkish. 130 p. Eaton Mfg. Co., 739 E. 140 St., Cleveland, Ohio. $6.00.

A comprehensive design study of valve-gear problems. Design formulas and computations for cams, tappets, and valve springs, profusely illustrated with line drawings, curves, and charts. Mathematical tables to aid in the solution of certain types of cam design problems. Formulas for calculating contact stresses. Laboratory studies of various types of valve-gear mechanisms in relation to design applications.

27-210. Praktische Verzahnungstechnik. (Practical Gear Tooth Generation.) Edition 3. 178 p. Walter Krumme. Carl Hanser Verlag, Munich 27, Germany.

Various modern methods used in the production of efficient gears. Clamping devices and wheel truing devices for gear grinding machines. While not neglecting the various chip producing methods of generating gear teeth, grinding and lapping methods are dealt with extensively. Data for calculating operation times for the various machine types.

27-211. Les Metaux et Alliages. (Traite de Metallographie.) [Metals and Alloys. (A Treatise on Metallography.)] Jean Marechal. 303 p. Editions Soledi, Liege, Belgium.

The first part is a general study of metals and alloys—allotropy, solid solutions, alloys, equilibrium systems, LeChatelier's law. Metallographic techniques and physical, mechanical, and chemical properties. Part II reviews the metallographic properties of each of the more important metals and its alloys.

27-212. Mechanical Vibrations. J. P. Den Hartog. Edition 3. 478 p. McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York, N. Y. $6.00.

Essentially a revision of previously published material. New material on electronic instrumentation, torsional vibration dampers, airplane wing flutter, and helicopter ground vibration.

27-213. The Metal Bulletin's British Iron and Steel Directory. 224 p. 1947. Metal Information Bureau, Ltd., Princes House, 39 Jermyn St., London, England.

A classified directory of producers, merchants and agents of iron and steel intended primarily for the use of overseas buyers.

27-214. British Nonferrous Metals Directory. 224 p. Metal Information Bureau, Ltd., 39 Jermyn St., London, England.

The suppliers of British raw and semifinished nonferrous metals.

27-215. Metal Working and Heat Treatment Manual. F. Johnson. Volume II. 226 p. Central Technical College, Birmingham, England. 17s. 6d.

Volume I of this series dealt with carbon steels only. The present volume deals with alloy steels, cast iron, and nonferrous metals.

27-216. The Escalator Method in Engineering Vibration Problems. Joseph Morris. 270 p. Chapman & Hall, Ltd., 37 Essex St., W.C.2, London, England.

An account of the methods of solution adopted or developed by the author for dealing with strength and vibration problems in engineering practice, in particular, in aircraft engineering.

27-217. The Manufacture of Refractories and Information Concerning Their Use in the Iron and Steel Industry of Western Germany. G. E. Seil, S. M. Phelps, F. L. Toy, J. W. Whittemore, A. T. Green, J. H. Chesters, M. Douglas, M. F. Goudge and G. R. Rigby. 112 p. Mapleton House, 5415 17th Ave., Brooklyn 4, N. Y. (Reproduced from FIAT Final Report No. 432; and PB 37804, Office of Technical Services, Dept. of Commerce, Washington.) $3.00.

Results obtained by a British-American team visiting 15 refractory and two steel plants. A brief summary of information is followed by details of each visit. Except for the use of carbon hearths, differences from British and American practice are not noteworthy. The appendix contains translations, in whole or in part, of four reports of the Steelworks Committee of the German Iron and Steel Institute on standardization of various refractory shapes and materials.

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